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COVER PICTURE

Canada's western coal mines produce millions of tons of lignite annually for domestic needs and export as well. At the Western Dominion Coal Mines at Taylorton, Saskatchewan, in the Estevan-Bienfait coal fields, mining is by the "stripping" method. Electrically-operated shovels and draglines strip the earth from the seams, most of which lie within 50 ft. of the surface. A giant stripping shovel operating at night is shown on the cover. This shovel works 24 hours a day, six days a week.
—*National Film Board photograph.*

HOUSING PROBLEMS AND HOW HOUSING ENTERPRISES IS SOLVING THEM

D. H. STORMS
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An address delivered before the Hamilton Branch of The Engineering Institute of Canada, on September 26th, 1946

THE AUTHOR *enumerates the many causes of delay plaguing the house builder today, and offers some constructive suggestions for avoiding them or lessening their effect. The set-up of Housing Enterprises Limited is explained and its functions outlined. This privately financed corporation's methods of designing and building mass housing, and its system of tenant selection, are described.*

It will probably be admitted by even the most disinterested of thoughtful people that there definitely is a housing shortage in Canada. However, even that simple premise will be contested in these days of conferences, arbitration and talk, which too often delay and sometimes actually replace desperately needed action. A re-assuring writer in a recent issue of a certain trade journal attempted to show, from population statistics, that the 1946 occupancy rate of 4.37 persons for every dwelling indicates less overcrowding in Canada today than in any year since 1881. He made no allowance for the larger families of those days, requiring fewer homes for a given population, or the prevalence today of three-roomed apartments in place of more spacious dwellings. To achieve any fair comparison between occupancy rates over these six decades it should be based, not on persons per house, but on families per room. Such comparison would show a shocking condition in view of our present advanced standards of housing and hygiene.

Even the Rt. Hon. C. D. Howe admitted in a statement on housing given to Parliament last July that 150,000 units represented the minimum immediate shelter requirements. He added that by spring of 1947, thanks to more war brides and babies, there would be a housing deficit of 180,000 units. This figure takes no account of replacement of sub-standard homes, prewar overcrowding, or the attainment of a desirable vacancy rate. It is the minimum of new homes needed.

The two chief factors that created this shortage are the sharp decline in building during depression years, and the six years of war during which there was a minimum of permanent house construction. These basic factors have been further magnified by a highly increased marriage rate ever since 1940. Then, there have been several marked shifts in centres of industry during and since the war, leaving in their wake thousands of misplaced or transient workers and their families. The generally higher incomes today have created an expanded appetite for better housing, and the servant problem and income taxes have made the large house generally obsolete.

Mr. Howe estimated that to meet the need adequately we should build some 540,000 units during the next six years, approximately as follows: during 1946, 60,000; in 1947, 80,000; and in the following four years 100,000 annually. This is a sizable programme at any time compared with the average annual production to date of about 32,000 units annually. Today, with shortages of material and skilled labour, and the multiple requirements of municipal, provincial and federal bureaucracy, it is a staggering undertaking.

Before outlining some of the main difficulties, it should be pointed out that these remarks refer strictly to housing for the low to moderate income groups, or housing appropriate for the majority of our veterans. The rich will manage to build their homes in spite of the difficulties.

Delays From Shortages

Principal among these difficulties are material shortages, which will be worse before they are better, and are not confined to any one class of building material. Lumber of all kinds is scarce and largely unseasoned. Steel, copper and brass products are daily becoming scarcer due to continuing strikes. Shortage of pig iron has affected output of soil pipe, plumbing fixtures, pipe and fittings of all kinds. Sewer pipe and flue-lining are equally scarce, paper and asphalt products only slightly less so.

It is not necessary to delve deeply for the reasons. Strikes have certainly interfered with production, but these are not all on the side of labour. Certain industries have also " struck ", in effect, for higher prices or lessening of excess profits taxes. There has been dishonesty on the part of unscrupulous manufacturers and dealers who have chosen to deal in the black market both here and across the border. Conversion of industry has not always been prompt, due to conflict between management and labour, and between management and Government. The normal channels of supply, so disrupted in the interests of speed during the war, have not been fully restored. Much material is being used in construction less essential than housing, such as theatres, bowling alleys, banks, churches and " pop stands ".

Some material shortages can be alleviated by using substitutes. For others there are no substitutes, and construction delays are inevitable. For instance, where the municipality is unable to provide water and sewer services through lack of pipe, the house-builder must often go out of his way to find a water supply for his concrete. It is impossible to grade and surface the site and prepare winter construction roads if trenches cannot be back-filled. Where tile or cast iron floor drains are not available basement floors are held up, or a chase or trench must be left in the concrete. Plastering is held up for lack of water-pipe to be installed in walls, or a chased area must be left for later insertion. These postponements add to costs, and are reflected directly in higher purchase prices and rentals.

Next, labour shortages and stoppages, of both skilled and unskilled workmen, extend right through the piece: at the source, in manufacturing plants and on construction sites. The reasons are well known: First, we lost six years' production of new skilled tradesmen due to the diversion of young men to war. Now, on their return, no longer boys but adults with families to support, they naturally avoid unskilled labour or apprenticeship, with low earnings. The trades themselves are doing little to improve the situation; they jealously maintain restrictions on union membership, making it difficult for non-union workmen to get work and so qualify themselves on the job, while earning enough to support their families. Moreover, the tradesmen who have gained and are thus guarding a near monopoly of the skills, will use those skills only to a limited extent and for limited hours. The man who, in recognition of the emergency, would gladly lay his full pre-war potential of 1000 bricks a day, is practically outlawed by his fellows if he lays more than, say, 400. So, with lumbermen in the woods, with moulders in steel mills, and with carpenters on the job, the story is the same: there is not enough skilled or near skilled labour.

Delays From Other Causes

As for the red tape of building codes and administrative bureaucracy of all kinds, there are literally scores of separate agreements or approvals required for every large-scale housing project even to the start of construction, and many more minor adjustments that during construction have to be settled to the stubborn satisfaction of all parties. There could well be a cutting of red tape in all directions to achieve a more or less Dominion-wide standardized building code. Indeed, standardization could be carried into the field of town planning and zoning. Local zoning by-laws often impede the most economic installation of services, the fullest use of land, or the most attractive lay-out of houses.

Sometimes the municipal authorities are willing to amend such by-laws in their own interests, but adjacent home-owners protest any special concessions to large-scale builders. The fact that these agencies have been called in only to provide faster and more effective relief of the existing need is overlooked. The municipality at last satisfied, the whole project must still be approved as in conformity with provincial planning and development regulations; estimated rentals must be satisfactory to the Wartime Prices and Trade Board; and all costs must be approved at Ottawa before the Privy Council is asked to authorize the required loan under the National Housing Act.

The routine of calling tenders and letting contracts is aggravated today by the natural reluctance of contractors, in view of current shortages, delays, rising wage scales and rising price ceilings, to be pinned down to any price, no matter how loaded with contingencies.

Measures to Overcome Delays

This gives a dark picture of the housing problem. Yet, we should not become discouraged, for there are bright spots also. There is a general recognition of the urgency of the situation. Much has been done to facilitate the financing of large and small housing projects, through enlargement of the provisions of the National Housing Act, and their extension to lumber and mining companies to build employees' housing in outlying areas, to private builders to permit them to undertake larger-scale building than they could otherwise afford, and to private companies such as Housing Enterprises of Canada Ltd. for the construction of rental housing. The centralizing of both the federal financing authority and the federal supply authority under the one department, Reconstruction and Supply, has meant increased efficiency. Central Mortgage and Housing Corporation has under its jurisdiction the financing of all priority building, and only with its approval is the "Authority Priority Housing", or A.P.H., issued, which gives priority on construction materials of all kinds.

A.P.H.'s are available to Wartime Housing, Housing Enterprises of Canada, Veterans' Land Act building, Integrated Housing projects, and two agencies that produce dwelling units by conversion, Home Conversion and Emergency Shelter. Their issue has been extended to individual veterans who are building homes, within a price range, outside the V.L.A. though little use has been made of this as yet. A.P.H.'s are reserved to the low to moderate cost field. The prices that can be secured for luxury housing seem to provide adequate compensation and incentive to the speculative builders without any aid from Ottawa.

Agencies Engaged in Building Group Housing

Wartime Housing is a crown company which, since the war, has been constructing rental housing for municipalities, subject to provision of free land and services, and tax concessions. The houses conform to National Housing Act minimum standards, and most are without basements and furnaces. These omissions, combined with the quasi-subsidization of municipal concessions, permit their rental at lower rates than those of Housing Enterprises, to which they are otherwise comparable. Wartime Housing operates in the lowest rental field as far as new housing is concerned.

Veterans' Land Act building, under the Department of Veterans' Affairs, is largely for individual veterans who have taken advantage of the Government's liberal financing arrangement, with grants up to $1,300, for building their own homes. They may employ their own builders, but plans and costs must be approved by Central Mortgage and Housing Corporation to secure loans or priorities. A recent regulation requires the veteran to build on at least two or three acres of land, making the V.L.A. strictly a rural building agency. The "Home Conversion" scheme provides Government loans to owners of buildings for the purpose of remodelling them to new or additional dwelling units, while the "Emergency Shelter" scheme provides Government grants to municipalities for the conversion of buildings to the same purpose.

Housing Enterprises is a private company, owned by the life insurance companies that do business in Canada, using Government loans secured by mortgages. It operates in the rental field immediately above Wartime Housing, without municipal concessions of free land and tax exemptions, and their specifications are more generous, including full basements and furnaces. These features increase rentals, but make the projects more attractive to municipalities, being aimed at economic rentals. Estimates of the economic rentals set, based on estimated construction costs, must be approved by the Wartime Prices and Trade Board before construction begins. But costs today being unpredictable, should final economic rentals exceed those authorized by the Rent Controller, presumably the Company must operate at a loss. Anticipating this the Government, when it asked the life insurance companies to enter the field of rental housing, guaranteed them a 2½ per cent minimum return on their investment, while permitting them a maximum 5 per cent return if this could be achieved.

What Housing Enterprises is Trying To Do

First, there must be assurance that a sufficiently enduring need for the company's standard of rental housing exists in a given community to warrant a project of at least fifty units. Prospects must satisfy not only the mortgage men of the insurance companies but also the Government, which is both the mortgagee of the project and the guarantor of the owner's investment. Then property adequate for such a development must be located, convenient to employment centres—for working men are our logical tenants—yet one likely to retain its residential character for at least fifty years, the life of the investment, and the estimated useful life of the project. In order to keep costs down city-owned land is sought, with lowest service costs obtainable, for concessions on land and services by a municipality are reflected directly in lower rentals.

During 1946 this company is building 3500 housing units, about one-third of the number originally planned, on account of shortages in materials and labour. These 3500 comprise three standard types of dwellings, single houses, apartments and row or terrace housing. Each house type lends itself readily to variation in exterior details. They all take a square form for economy, hall space being sacrificed to living quarters, and all rooms are generally 10 per cent larger than N.H.A. minimum standards. The houses are of permanent construction, with ten-inch concrete basement walls, treated for waterproofing, and with insulated roofs. Original plans included concrete block and brick veneer construction, but due to local shortages of brick, block and bricklayers, the proportion of frame houses has been increased.

Designs and Layout of Group Housing

Apartments are designed in standard blocks, permitting many variations in design and layout. The blocks are two or three-storey, with two suites per floor, are entered by a central stairway and have rear stairs also. The apartments contain one to four bedrooms, heated from central heating plants, and equipped with refrigerators and stoves. Row or terrace housing consists of two to six-unit blocks, with units of two, three and four-bedroom design. Each unit is of two stories, with separate front and rear entrances and full basements.

All projects respect local tastes and building practices. In western communities, for example, stucco exterior replaces brick veneer and concrete block. In Saint John, coal and wood-burning kitchen ranges call for chimneys with double flues. On the West Coast the local preference is for fireplaces.

Local town planning commissions and consulting town planning engineers are always first consulted. Departure from the standard grid pattern avoids through streets and traffic, provides for green areas and play spaces, and usually achieves more lots per given area. Large-scale planning for an entire subdivision means economy for the municipality in the installation of services, and assurance of the permanent character of the neighbourhood. Terms for land and services vary in different municipalities, and are recorded in formal agreements. In some cases, in recognition of generous concessions by the municipality, the project will probably revert to it when the original financing by the company and by Ottawa is paid off.

Methods of Getting Them Built

Calling for tenders in the normal way is customary, giving competent local builders, large or small, a fair chance. We realize that customary building is somewhat reduced today due to lack of materials, for which we have certain priorities. Housing Enterprises has an understanding with the National House Builders Association that tenders from small builders would be accepted if submitted jointly by a number sufficient to undertake an entire project. It was hoped that small builders might achieve lower costs, but tenders showed otherwise, consequently most contracts have been awarded to large firms. In one case three small builders have combined on an apartment project and are giving an excellent account of themselves. Where there is little response to a call for tenders, time is often saved by going directly to a reliable contractor with the offer of a contract.

Lump sum bids are rare, and generally include allowances for contingencies such as exorbitant prices. It has become standard practice, therefore, to negotiate with the lowest of the reputable bidders on a so-called " target price " which includes the estimated costs of construction, allowance for off-site and on-site overhead, a fixed fee, plus a good contingency allowance. If the contractor keeps costs below the target, he receives 25 per cent of the saving, in addition to his fee. If his costs exceed the target, he receives the fixed fee only, and the contract actually becomes a cost-plus arrangement. Estimated rentals, as submitted to the Wartime Prices and Trade Board, are based on " target price ".

To avoid the anticipated delays, the Purchasing Department makes an early forecast of material requirements. Manufacturers and dealers are then queried as to delivery dates. Where it appears that production may be uncertain or slow, or where manufacturers are unwilling or unable to commit themselves to a large production programme, large-scale orders are placed. For example, orders were placed nearly a year ago for 3,000 warm-air furnaces and 5,000 kitchen cabinets and medicine cabinets, at a big saving in costs. When tenders are called, contractors are instructed to omit these items from their bids. Recently, in spite of this foresightedness, deliveries of furnaces and plumbing fixtures almost ceased owing to lack of steel and pig iron, occasioned by strikes.

Salvage Operations

Housing Enterprises' latest venture, one of the wisest yet undertaken, is in the field of wrecking and salvage operations. With the approval of Ottawa, several former service camps were purchased from War Assets Corporation, and a great deal of almost priceless material, lumber, plumbing, wire and electric fixtures, piping, is being salvaged therefrom. This material is saving costly delays in construction. All material is inspected, and the reports from the jobs have been excellent. Surplus salvaged materials are offered to other priority housing agencies.

Advantages of Mass Production

A word should here be added about the mass building of houses and the opportunity for low costs and speedy erection through " chain " production. Visualize a series of gangs starting out in succession, each allocated to a specific task and going from house to house doing the same or similar operation on each. This represents a " chain " and the number of chains may be suited to the job. Maintenance of an orderly sequence depends upon an ample supply of the skills required, and an adequate flow of materials. Unfortunately, neither of these conditions prevails today, hence the main advantage of mass building is lost, and costs approximate those of individual builders.

Selection of Tenants

In the realm of landlording the first problem will be tenant selection. In an owners' or " sellers " market like that of today, it would be satisfactory indeed to be able to pick and choose tenants for their financial capacity and desirability. However, by our agree-

(Continued on page 18)

NAVAL CABLES IN THE WAR

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An address delivered before the Montreal Branch of The Engineering Institute of Canada on April 4th, 1946

This paper describes how industry has cooperated with naval authorities in converting English cable-designs to those suitable for Canadian conditions. It describes manufacturing operations and design features, made more difficult by Japan's capture of our chief sources of tin and natural rubber. It also describes some special cables used for harbour defence and the destruction of acoustic and magnetic mines.

The authors explain difficulties encountered in cable installation, and uses of electrical cables by the Royal Canadian Navy. The development and installation of different types of equipment during World War II are discussed, including a study of the magnetic field caused by a ship, its effect on the magnetic mine, the main principles of the German magnetic mine, and how floating cables were used for sweeping them.

At the beginning of the war, British Admiralty naval specifications were in use in Canada. The designs and materials referred to in these specifications were based on British cable making practice. One of the first problems of Canadian cable makers was to revise these cable designs to bring them in line with Canadian cable making practice. The cable makers made direct contact with Canadian representatives of the British Admiralty in the revision of these designs, enabling cable makers to get into production on the more urgently needed cables. It was soon found, however, that this arrangement was not the best, especially when it is considered that there were about 670 different designs of cable to be considered.

In prewar years " The Wire and Cable Manufacturers Technical Committee " was made up of representatives from engineering staffs of various cable makers in Canada, and was formed to consider various technical questions of common interest. The various branches of the Department of Defence, the Department of Munitions and Supply, the British Admiralty Technical Mission and the said Technical Committee therefore formed a committee, designated as XC—1, under the auspices of the Canadian Standards Association, to provide co-operation between the cable makers and the technical personnel of all the armed services. One of its first problems was to complete the revision of the specification to conform with Canadian cable making practice.

Early in the war it was realized that too many cable makers were making the same type of cable. In the interest of production, the various designs of cable were allocated to different makers so that, in general, only one manufacturer would be required to make any one particular design of cable.

The amount of naval cables made by the company with which the authors are associated was approximately as follows: for naval shipbuilding and refitting 15.8 million feet, for degaussing 7.4 million feet, for anti submarine cables 0.375 million feet, and anti-mine cables 0.123 million feet, a total of 23.7 million feet.

The cables weighed about 5,000 tons, included about 250 different designs and required the insulating of about 58,000,000 ft. of conductor. About 60 per cent were made for the Royal Navy and 40 per cent for the Royal Canadian Navy. Following is a description of how these cables are made and some of the problems encountered in making them.

Conductors

The conductors are of electrolytically refined copper.

The wire drawing operation starts with copper rod. This rod is ¼ in. dia. and in 1200-ft. coils of about 250 lb. The cable maker welds the coils of rod together for continuous wire drawing. The rod is stretched by drawing it through a succession of Carboloy and diamond dies, each reducing the wire one size B & S. The continuous wire-drawing machine may contain eight to sixteen dies depending on the fineness of the wire. A capstan pulls the wire through each die and the wire travels faster through each succeeding die. The dies are flooded with lubricant.

In this country, both solid and stranded conductors follow the Brown and Sharp gauge up to No. 4/0 B & S and for larger sizes they follow the circular-mill areas. In Britain, solid conductors follow the Standard Wire Gauge, but stranded conductors are made up of a number of wires of S.W.G. size, stranded together.

For those cable makers who draw their own wire, it would not have been very inconvenient to work to S.W.G. sizes but this would have increased the number of sizes of wire they must stock, which was undesirable during wartime. It was therefore agreed to work to Canadian standards and a large proportion of the wire sizes in the naval specification were changed to this end.

Annealing

Copper wires to be insulated are annealed to make them softer and more flexible. Annealing may be done in a " wet " or a " dry " furnace. In the former, the wire enters the furnace through a water lock and the atmosphere in the furnace is steam to prevent oxidation of the copper. The furnace is maintained at temperatures of from 600 to 900 deg. F. according to the type and size of wire and the annealing time is only long enough for the proper temperature.

In the " dry " type of furnace the copper is placed on a truck and covered with a metal hood. The truck is then placed in the furnace. The atmosphere inside the hood is an inert gas such as nitrogen or burnt illuminating gas, which prevents oxidation of the copper during annealing.

Wire Coatings

Practically all conductors of naval cables are copper, and when insulated with either natural or synthetic rubber, they must be coated to protect the copper and the rubber insulation from attacking each other and to assist in soldering.

Pure tin from the Dutch East Indies was originally used in coating the copper wires. The wire is coated by drawing it first through liquid flux and then through molten tin.

When the Japanese took over the East Indies they cut off about 80 per cent of our tin supply. After consultation with the Technical Committee, the Metal Controller directed that we replace the pure tin coating with an alloy of 10 per cent tin and 90 per cent lead. Later the tin content was increased to 30 per cent.

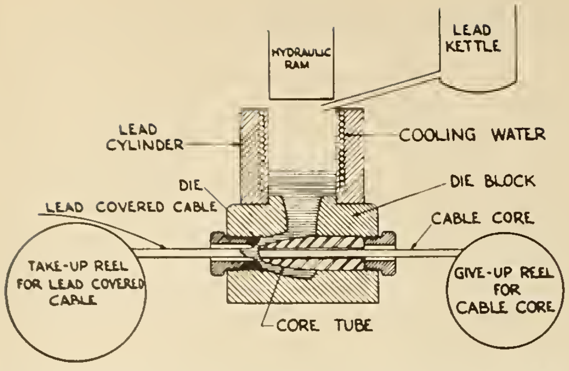


Fig. 1—Diagram showing the method of extruding lead sheath over naval cable, by means of hydraulic press.

Stranding

Conductors are solid, bunch stranded or concentric stranded. In naval cables a solid wire is generally used where the conductor is small, and not subject to movement after installation.

Where the conductor is small and is to be used in cables that may be flexed or roughly handled, the conductor generally consists of a number of fine wires of from about No. 28 to No. 34 B & S, i.e., all bunched and twisted together in the same direction. A number of bronze wires are stranded with the copper wires to give these conductors the necessary strength, annealed so as to have about the same elongation as the copper wires so they take their full share of any pull on the conductor.

Conductors larger than about No. 14 B & S are generally stranded in layers, each layer being stranded in the direction opposite to that of the layer underneath. When a large flexible conductor is desired, the solid wires of the stranded conductor may be replaced by strands, making what is called a rope-lay conductor.

Rubber Insulation

Rubber insulation is a compound of crude rubber, reclaimed rubber, curing agents, accelerators, antioxidants, softeners, reinforcing pigments and fillers, vulcanized together to provide the insulation with the physical and chemical properties required.

Crude rubber may be either natural or synthetic. The natural crude used in Canada, previous to Pearl Harbor, came mainly from Malaysia and the East Indies. The grade generally used in the cable industry is that known as " smoked sheets ", packed in bales of about 224 lb.

In formulating a rubber compound, the compound must mix satisfactorily, it must be capable of being applied to the conductor satisfactorily, it must cure satisfactorily, and it must meet all tests and operate satisfactorily. The rubber chemist must choose the proper materials in the proper amounts and have them added in the proper order, mixed for the proper time, and extruded at the proper plasticity, speed and temperature to provide a rubber compound with the desired electrical, mechanical and chemical properties.

By capturing Malaysia and the East Indies, the Japanese cut off about 97 per cent of our crude rubber supply. Stock piles of crude on this continent had to be conserved so they would last until synthetic rubber became available.

The type of synthetic rubber produced at Sarnia is called Buna-S. Buna-S containing about 25 per cent styrene is designated as GR-S. The technique of mixing GR-S compounds differs little from that of mixing natural rubber compounds but certain changes in the ingredients are important. GR-S is less tacky than natural rubber and there was an intensive search for suitable tackifiers. When one was found, the demand quickly exceeded the supply and the search continued for another. Certain fillers were found to give the compound better characteristics than others. During this period of change-over, cable makers had to develop a " synthetic-rubber " technique in a few months to replace a " natural-rubber " technique that had been gradually built up over the past 30 to 40 years. But today there are, on every sea, ships in which synthetic rubber insulated cables are operating successfully.

All ingredients, except sulphur and accelerators, are generally mixed in a Banbury internal mixer. The rubber compound is then strained by forcing the rubber compound through the screen of the strainer by means of a worm. The sulphur and accelerators are generally added after the straining operation so as to avoid premature curing due to the heat of the previous operations.

Rubber compound may be applied to wire by either the strip or the extrusion process. In Britain insulation is usually applied to conductors by the strip method, wherein the rubber compound is rolled into strips in a calender. The sheet of rubber is cut into tapes on one of the rolls, and applied to the conductor longitudinally. Several tapes may be applied, one over the other, with the seams staggered.

The extrusion method is used in Canada and it was therefore necessary to have naval authorities agree to this method. In this process, the soft, warm rubber compound is forced around the conductor by pressure exerted by a worm.

The wire is taken up in a pan containing powdered whiting. The whiting acts as a cushion for the wire and prevents turns from sticking together. The pans of wire are then placed in an autoclave in which they are cured or vulcanized under steam pressure. When large amounts of wire are to be rubber covered, the extrusion and curing is often done in one operation by what has been called the continuous insulating and vulcanizing process. The rubber compound is cured in a steam-filled pipe immediately after leaving the extruder.

Testing

Practically all rubber insulated conductors are immersed in water, after which they are subjected to a voltage test and their insulation resistance determined while still immersed. The minimum period of immersion was originally 24 hours but, because this was a production bottleneck, it was reduced to 12 hours.

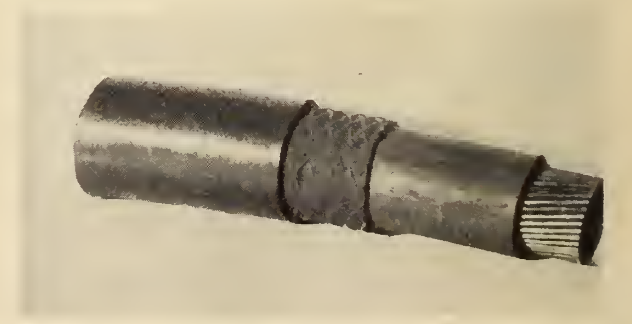


Fig. 2—Braid reinforcement between two rubber sheaths of cable.

Fig. 3—Single-conductor rubber-insulated cable used for harbour defence.

At this point of manufacture, the rubber insulation is also tested to determine its tensile strength, elongation, ageing performance, etc. In ageing the rubber insulation, the insulated wire is placed in a closed cylinder filled with oxygen at a pressure of 300 lb. per sq. in. and a temperature of 70 deg. C. for 96 hours. The effect of this ageing, on the tensile strength and elongation, is determined.

Taping and Printing

It was required that many of the rubber insulated conductors be covered with a rubber-faced cotton tape, wrapped helically on the insulated conductor with the rubber side in. In multi-conductor cables, the tape on each conductor bears a number printed on the cotton side for identification. These numbered tapes were not available in Canada at the outbreak of war. The numbers were, therefore, printed on the tape after it had been applied to the conductor.

Cabling

In making multi-conductor cables, the conductors are cabled together on a planetary strander. This type of stranding machine maintains the reels of conductors in the same orientation during their rotation around the cable and therefore, does not twist the conductors during the cabling operation.

The naval specification requires that the interstices between conductors be filled with rubber compound, since water might flow along the interstices if a cable in a flooded compartment became damaged. It is therefore necessary to extrude rubber compound over each layer of conductors before cabling the next layer of conductors.

Protective Coverings

All lead sheaths of naval cables consist of a ternary alloy of 0.15 per cent cadmium, 0.4 per cent tin and the remainder lead. British Admiralty has found this alloy to be the most suitable to withstand the vibration their cables are subjected to on shipboard.

One of the methods of producing the lead sheath is by extruding the lead over the cable by means of a hydraulic press. The molten lead is poured into the cylinder of the press and allowed to solidify. The lead, while still hot, but plastic, is forced through a die-block by a hydraulic ram and is formed around the cable as shown in Fig. 1.

Rubber sheathing compound is somewhat similar to rubber insulating compound except that it is designed to have extreme toughness regardless of electrical properties. It is extruded, using the same type of machine that extrudes rubber insulation. Rubber sheaths are often vulcanized in a lead mold, that is, a lead sheath is extruded over the unvulcanized rubber and removed after curing. This tends to make the rubber sheath more dense and give the surface a smooth and even appearance.

Some naval cables are designed with a reinforced rubber sheath, that is, they have two sheaths with canvas tape between them, applied longitudinally over the inner sheath, with edges butting. This type of reinforcement has not been used by Canadian cable makers, as far as the authors know. On account of the importance of starting delivery of cable as soon as possible, and the fact that canvas of the type specified was almost unobtainable, naval authorities agreed to accept a type of reinforcement with which the cable makers were familiar, consisting of an open hawser cord or seine twine braid. Such a braid is shown in Fig. 2. The two rubber sheaths, with the open braid between, are then cured under lead.

Some Naval Cables

One of the larger cables contains forty-three rubber insulated conductors. The insulated conductors are each covered with a numbered, rubber-faced tape. They are cabled together with a lay-up of 1-7-14-21, that is, there is one conductor in the centre, with seven in the first layer, 14 in the second layer and 21 in the third. Where each succeeding layer increases by more than six conductors there is an annular space between layers.

Some cables were covered with a tough rubber sheath whereas others were covered with a lead sheath. A number of cables were designed for use where they would be in contact with oil. In this case, the cable was covered with two layers of varnished cambric and a cotton braid impregnated with paint, offering resistance to fire and the absorption of oil.

One cable, used for harbour defence and shown in Fig. 3, was designed to lie dead at the bottom of a harbour. It was a single conductor rubber insulated cable, loaded with lead wires and single wire armoured. An interesting feature of this cable was that the interstices in the stranded conductor were filled with rubber so as to prevent water from penetrating along the conductor if the cable became damaged.

This cable was required in lengths of 18,000 ft. but 6,000 ft. was about the maximum length that could be insulated and loaded with lead wires. Three sections of lead-loaded cable were therefore spliced together and then wire-armoured to provide an 18,000-

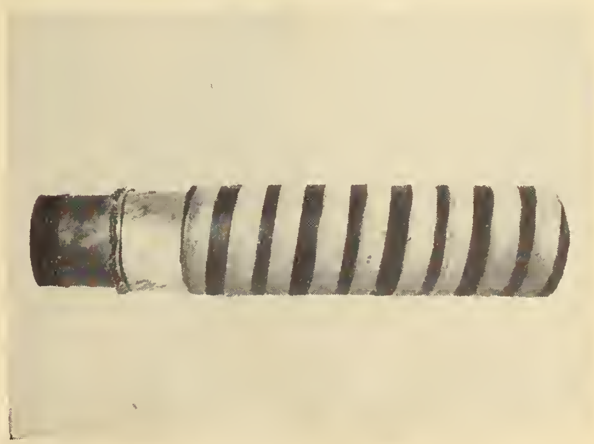


Fig. 4—Buoyant cable.

ft. length of completed cable which weighed about 23 tons.

A cable used in destroying acoustic mines consisted of five rubber insulated conductors made up into three single-wire armoured units cabled together. This construction was chosen because the cable had to be sufficiently flexible to withstand coiling and uncoiling during each operation in service.

Probably one of the most interesting cables is that designed to float on the water and shown in Fig. 4. Although several designs of cable have been made, only cable of one basic design was manufactured in Canada. These cables consisted essentially of two layers of tinned copper wires stranded around a buoyant core and covered with rubber insulation and a rubber jacket. The buoyant core consisted of cork or hard cellular rubber blocks separated by discs of soft cellular uncured rubber or neoprene to provide flexibility. Over this buoyant core were stranded four hundred No. 18 B & S medium hard drawn tinned copper wires.

The insulation consisted of rubber. A layer of rubberized canvas reinforcing tape and a rubber sheath were applied over the insulation. The discs, insulation and jacket were vulcanized under a lead sheath. The cable had an overall diameter of approximately 3.5 in.

This being a buoyant cable, it must float. It required 400 lb. of lead to keep 1200 ft. of this cable submerged in the testing tank.

Cabling Conditions and Requirements on Shipboard

During the early stages of the war, the Canadian Navy personnel were few, and for the most part quite unseasoned. It was inevitable that heavy responsibilities should be placed on men entirely inexperienced in naval matters, especially in the electrical field where so many new devices were being thrust into action before properly proving themselves. The ship itself may be aptly pictured as a floating power plant and the demands for cable are many and varied. Under these conditions it fell to cable manufacturers to supply most of the answers to the particular cable problems which repeatedly arose.

The importance of cable in the life of the ship cannot be over-emphasized. It is the channel by which the pulse is fed to every part of the ship. All navy cables are working under the worst possible conditions, due to continual exposure to water and

Fig. 5—Ice accumulation can make a 1/8 in. dia. cable grow to 6 in.

moisture, excessive heat and cold, icing conditions, and continuous vibration and movement of the ship itself. The corrosive action of salt water is well known and is an ever-present threat to the useful life of all cables wherever installed. For this reason there is a definite tendency to run to lead-covered cables in ship installations. On all modern ships there is much oil to contend with, and in the boiler and engine room many of the cables are unavoidably subjected to considerable heat. In rough seas during cold weather the accumulation of ice is amazing and a cable 1/8 in. dia. will grow to a 6 in. dia. in a very short time. (Fig. 5)

The installations of cables on shipboard are not far different from those made ashore. The same methods of making joints, splices, connections, etc., apply in both cases. The lack of space in a ship causes more congestion and therefore a more compact and neater installation is required. While installing electrical gear in a naval ship, it must be kept in mind that during the execution of duty no electrical failures must occur as this might easily result in loss of life. Maintenance duties are always at a maximum in a ship even at the best of times and especially so during enemy action. For this reason cables designed for the Navy are generally of a heavier construction than those normally employed. Lead-covered cables generally have a heavier sheath than standard. In most multi-conductor cables, unvulcanized rubber fillers replace the jute generally used.

One of the most important features of any ship is its water-tight compartments which must be kept intact at all costs. In running cables through the ship, these compartments and other bulkheads must be penetrated, and a water-tight gland must always be employed. Glands are of the usual type consisting of a packing which is screwed up tight around the cable. In all bulkheads, other than water-tight bulkheads, ordinary bushings are used to protect the cables.

Destroyers, frigates and larger ships are generally fitted with emergency circuits which may be readily connected up during failure in any part of the ship due to gun-fire, collision, or other causes. The ship is divided into compartments each with an auxiliary switchboard fitted with fuses and pilot lamps. In convenient locations throughout the ship there are wall racks containing coils of flexible cable. In an emergency, by connecting up from bulkhead to bulkhead with the flexible cable, a complete circuit may be run from the source of power to any part of the ship. To provide a quick method of pumping throughout the ship, and to assure the necessary power special connections are installed at six or eight points with flexible rubber leads to a portable pump.

A type of submarine or underwater cable is employed for controlled mines and permanent sea-bed installations and is of the usual jute protected steel wire armoured type. Single conductor cables sometimes require additional weight to prevent movement on the sea bottom and are therefore given a serving of lead wire. This type is used for leads to controlled mines and to indicator and guard loops to indicate the presence of traffic in vital areas such as the entrance to a harbour. This type of cable must withstand severe punishment where it enters the water.

Although the majority of cables are lead covered for protection against water, there are a number of flexible leads required for power, telephone, and firing circuits to revolving turrets where a lead-sheathed cable would not be practical. In some cases the outer covering of these flexible cables must have special flame or oil-proof treatment where there is excessive exposure to this source of trouble, and an outer bronze or galvanized steel braid. Light circuits to mastheads, and microphone and Aldis lamp leads are generally metal braided.

Magnetic Field of the Ship

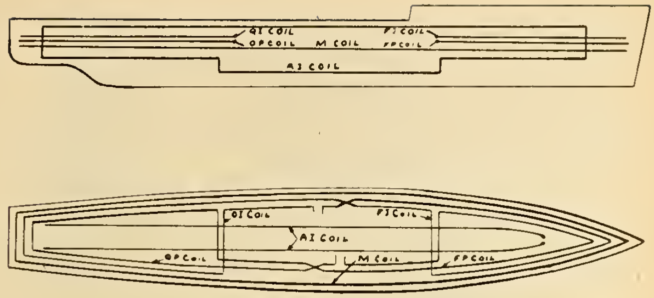
Degaussing was the Royal Navy's answer to the German magnetic mine. It derives its name from the gauss which is the unit of magnetic flux. Every ship has a magnetic field and the Germans took advantage of this fact to devise a magnetic unit which would be actuated by the increase or decrease of the earth's magnetic field as a ship moves near it. The main component of the ships magnetic field is induced by the earth's field. In the vicinity of the North Atlantic trade routes, the earth's field acts down through the ship at roughly 20 deg. from the perpendicular. Its vertical component is therefore much greater than its horizontal component and the German magnetic mine is designed to be actuated by the vertical component.

In addition to the induced field there is also a permanent field of magnetism which is set up in the ship by the earth's field while the ship is either lying in one position for a long time or during a shorter period in which the ship is subjected to excessive vibration such as riveting. Both the permanent and induced fields in the ship may be broken down into vertical, longitudinal or athwartship (horizontal across ship) components, and each can be considered and neutralized separately. Degaussing coils are installed to give a counter magnetic effect to that of the various components. The vertical component is the strongest and is compensated for by the main (M) coil, as shown in Fig. 6. The longitudinal component is neutralized by the forward (F) coil and the quarterdeck (Q) coil. The athwartship component is neutralized by the athwartship coil.

The ampere-turn has been generally accepted as a standard and convenient unit for referring to the magnetic strength of a coil. The degaussing circuit itself originally consisted of an M coil only, consisting of a few turns of cable fed through a switch from the ships generator. At the beginning of the war, little was known regarding the magnetic effect of coils on a ship and the first methods of determining the design of the degaussing coil was based on a trial and error method involving the dimensions of the ship and a multiplying factor. The coils ranged all the way from 300 to 3000 ampere-turns, according to the size of the ship.

The vertical component of earth's field varies from a maximum at the poles to zero near the equator. It is therefore necessary to adjust the strength of the degaussing coil as the ship changes latitude. To make this as simple as possible, the earth was divided into zones and a different coil setting was assigned to each zone. As the ship crossed the equator, the current in the coils was reversed by means of a reversing switch and the variation of current was generally obtained by resistors or, in some cases, by a variable voltage generator.

In the early days most installations consisted of an "M" coil only but it was found that the neutralizing effect obtained from this method was not sufficient, as it compensated for the vertical induced magnetism only. This condition may be represented by a bar magnet running horizontally fore and aft in the ship.



TYPE 2 M, FI, QI, FP, AND QP LOCATION OF COILS.

Fig. 6—Diagram illustrating the action of degaussing coils on magnetic field of ship.

The F (forward) and Q (quarterdeck) coils which counteract this horizontal longitudinal component each run roughly one-third the length of the ship but vary considerably, as determined by the structure of the ship. The horizontal longitudinal magnetism may be divided into permanent and induced components. The permanent component, during the early stages of the war, was counteracted by permanent F and O coils. Although these are still used, "deperming" is the latest method of treating this condition.

Even small wooden ships, because of the metal in their engines, have sufficient field under them to detonate the more sensitive German mines and a small degaussing coil is installed around that part of the ship.

Installation of Degaussing

In the early days of degaussing, all coils were placed outside the hull to avoid the shielding effect of iron bulwarks. They were generally run just below the main deck and secured with pitch or wooden cleats. Rough weather damaged this type of installation and the cables had to be removed to the main deck inside the bulwarks.

Even there it was difficult to keep the cables in place. Steel clamps welded to the deck would be torn off, and the cables cut or broken adrift. An endeavour was sometimes made to cover the coils with a bitumastic cement, but it was found that the water would get at the cables, resulting in shorts and grounds. The bitumastic compound also made it difficult to locate the fault and this type of installation was soon abandoned.

Eventually the degaussing coil was moved completely inside the hull of the ship. It was found that the loss in efficiency due to the shielding effect, was roughly 15 per cent and additional ampere turns were allowed for coils designed for internal installation. Single conductor cables were gradually replaced by multi-conductor cables wherever possible, resulting in much neater and quicker installation.

Tankers had to be treated differently from other types of ships due to the nature of their cargo and their structure. It was impractical to run the coil through the oil tanks, which meant the cables had to be run along the well deck, generally under water. To meet this problem, the cables were laid in a steel pipe, and through a gland into the deck house. Unfortunately, at first, it was often found that the installer had failed to provide an expansion joint so the motion of the ship soon cracked the steel pipe and salt water short-circuited the terminals. A later method of installation employed on tankers uses a lead covered and armoured cable lying along the well-deck.

Deperming

Deperming consists of removing the longitudinal permanent magnetism induced in the ship during refit or while under construction.

The P.L.M. can be roughly calculated by running over the degaussing range with the degaussing off. Most deperming stations are a mobile floating unit containing heavy duty batteries, motor generator set, reversing switches, rectifier unit and a variable liquid resistor to control the current. Deperming cable, rubber sheathed, is used in two sizes 570,000 CM and 300,000 CM for larger and smaller ships respectively, and is supplied in various lengths with lugs at each end (Fig. 7) and spiralled around the ship under the keel and over the superstructure. Rubber sleeves are clamped over the connecting lugs to keep out water. Two magnetometers or flux meters are placed under the ship's keel approximately 1/3 the distance from each end to measure the changes in field strength as the P.L.M. is reduced. About 10 or 12 turns of cable are sufficient for the test.

The initial charge or pulse, lasting several seconds, builds up a P.L.M. roughly 2½ times the original P.L.M. of the ship, but in the opposite direction. Magnetometer readings are then taken and a current calculated to reverse the P.L.M. back to 50 per cent of the original. The next pulse is calculated to bring the field to approximately zero. Two or three pulses of alternating polarity are then given the ship in rapid succession. Deperming eliminates the necessity for FP and QP coils. It should not be necessary to again deperm the ship until after a long refit or lay-up, but this can be determined periodically by ranging.

Wiping

Wiping stations were introduced in the British Isles to eliminate the necessity for degaussing coils in small coastal traders. As these ships always operate in the same zone, there is no necessity for a change of coil strength. Instead of installing a variable degaussing coil, the ship is treated by means of a horizontal coil wrapped around the ship just above the water line carrying heavy pulses of current. This places a semi-permanent vertical magnetic pole in the ship which is approximately equal and opposite to the induced vertical field. The coil is moved up and down the sides of the ship to avoid making local poles in the structure of the ship, hence the term "wiping."

The earth's field is continually weakening the effect of wiping and ships treated in this manner should be degauss-ranged approximately every three months and if necessary be rewiped. Wiping is only applied to smaller ships where the longitudinal magnetism is small enough to be ignored with safety.

Fig. 7—Rubber-sheathed deperming cables on the deck.

Degauss Ranging

Degaussing coils are designed according to the size and shape of the ship, but each ship has its own little peculiarities and no two ships react to the coil in exactly the same way. To overcome this and to obtain the proper coil setting for each ship, it is necessary to send the ship over the degaussing range. This range consists of a number of coils laid in a straight line on the ocean-bed.

These coils are accurately spaced and levelled off by a diver and weighted to hold them in position. The range is buoyed at each end and the ship passes as nearly as possible across the middle of the range at uniform speed. Ranges are laid at various depths to accommodate ships of different tonnage.

The leads from each range coil run to recording galvanometers in the range hut. As the ship moves over the coils, a graph is recorded which is proportional to the magnetic strength of the ship's field and usually referred to as the ship's signature. Signatures are measured in milli-gauss, as this unit is best suited to measure the high sensitivities of the magnetic mine. By ranging, it is possible to determine at what depths a ship will be protected against magnetic mines, depending, of course, on the sensitivity of the mines.

Another method of reading a ship's signature, generally referred to as a "pot test", was employed during the earlier days of the war and is still used for deperming and other experimental work. It employs a flux-meter in a small box which is lowered under the keel of the ship on ropes. By moving it along the length of the ship and taking readings at various points, a curve may be plotted which is just as accurate as the ship's signature obtained on the range. The original flux meter boxes (Fig. 8) were designed by the National Research Council in Halifax and consisted of a small armature revolving between two Helmholtz coils. Enough current was fed through the coils to counteract the earth's field so that the armature winding was cutting zero flux. The ship's field caused an increase in either red or blue field and the armature winding then generated a certain electromotive force which was calibrated to read directly in milligauss. The difficulties in designing this flux meter box were many, such as keeping the box and the electrical connections water-tight at the depths involved and keeping the box level by means of gymbols. Although this was a cumbersome method, it was the only one in use on this side of the Atlantic during the first year of the war.

Magnetic Mines

The Germans were the first to make use of the magnetic mine in the war just passed, and although it cannot be stated that the Allies were prepared to meet this threat, at least degaussing was advanced to the stage where installation could be immediately commenced. The circuit of the German magnetic mine consists fundamentally of an explosive charge, a battery, and a magnetic switch generally called a magnetic unit. The magnetic switch may be represented by a straight bar magnet balanced on a fulcrum which, when moved by an outside magnetic influence, closes two contacts, completing the circuit to the charge. The German magnetic unit is held upright in a gymbols and is only influenced by the vertical component of magnetism.

The sensitivity of the mine is proportional to the strength of magnetic field necessary for detonation and is controlled by the distance which the bar magnet must travel before the circuit is closed. The change in the vertical field over the surface of the earth is considerable and allowance must be made for this when laying the mine. A device known as the automatic latitude adjustment is fitted, which allows the mine unit to take up a setting corresponding to the magnetic field in that area, after which, a pre-determined sensitivity setting is put on the mine.

Many anti-sweep devices were used. The most simple of these being an anti-shock or tilting switch consisting of a sensitive arm, easily vibrated, which opens the circuit to the detonator and prevents one mine in a field detonating the remainder by shock.

Probably the best known and most effective anti-sweep device employed by the Germans is the period delay mechanism (PDM). This is a device which makes it necessary to actuate the firing mechanism several times before the mine is actually detonated. In the first days of the war before the British had time to organize their magnetic sweepers, there was no PDM and the first ship or sweep over the mine caused detonation. The introduction of the PDM made it necessary to sweep the area as many times as the maximum possible PDM setting before declaring it clear of mines.

The number of possible PDM settings increased gradually up to 24 in the mines being laid at the end of the war. When fitted with PDM, an outside magnetic influence can actuate the unit in the usual way but instead of detonating the mine, it operates a clock and runs off the predetermined setting. The last actuation closes the circuit to the detonator and fires the mines. There were also numerous slow release devices consisting of mechanical or electrical clocks or the simple soluble plug. These meant that the mine could be laid hours or days before it attained a condition enabling it to be swept.

Before the days of degaussing, all ships had a large field under them and the sensitivity of the German mine was very coarse (approx. 80 or 90 mg.). As all ships in the northern hemisphere have a north or red field, the mines were designed to be actuated by a red field (a red mine) and were unipolar. At this stage the Allies were inclined to overdegauss their ships or in other words, to leave them with a small blue field. To meet this, the Germans commenced to lay a certain percentage of blue mines which made it necessary for the Allies to further improve their degaussing and place closer limits on the safe field under the ship. The German reply to this was to introduce the bipolar mine, which is actuated by either a red or a blue field, and to considerably reduce the sensitivity of their magnetic unit. At this stage, the enemy developed and introduced the magnetic-acoustic mine. This has both a magnetic and an acoustic unit. The acoustic unit is operated first by the sound of the ship and this cocks the mine or completes the circuit to the magnetic unit. As the ship reaches a position where its magnetic field is sufficiently strong to influence the mine, the circuit to the detonator is completed and the mine explodes. This combination unit allowed the magnetic sensitivity to be reduced beyond the range which had been

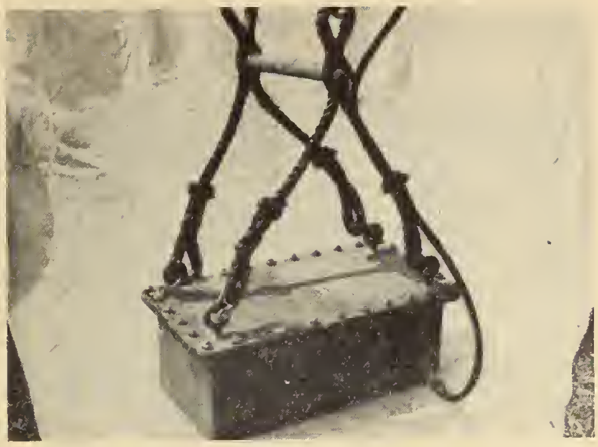


Fig. 8—Flux meter box of the type designed by the National Research Council.

practical up to this point, as sudden changes in the earth's field had formerly rendered the more sensitive magnetic mines uncontrollable.

Types of German Mines

Mines may be divided into two main classes, contact and non-contact. A contact mine must be contacted to produce detonation, while a non-contact mine is actuated by some outside influence originated at a distance. Contact mines are always moored while a non-contact mine may be either a moored or ground mine, that is, one which lies on the ocean bed. Moored mines, whether of the contact or non-contact type, are more effectively swept by an oropesa sweep which consists of a special serrated wire rope held off on the quarter by a float and paravane and towed at a specified depth by means of a multiplane kite-otter.

Non-contact mines must be swept by either a magnetic or an acoustic sweep. During the early part of the war, all magnetic mines were ground mines. The heaviest charge carried by this type of mine is approximately 1600 lb. and this weight of charge soon loses its effectiveness as the depth increases. Ground mines, therefore, are only swept for in coastal waters but with the advent of the moored magnetic mine and the magnetic pistol in torpedoes, it became necessary to extend this sweeping to deeper waters and to keep the degaussing circuit energized in any area considered dangerous, regardless of depth.

The Germans laid their mines from the air and from both surface and underwater vessels. They were either cylindrical or spherical shaped. The type "G" was one of the most effective of all German mines. It carried 1620 lb. of explosives and was equally effective as a bomb on land, or as a mine in the water. It was fitted with an impact fuse which detonated on contact with any solid substance, while if it landed in water, it acted as a ground magnetic mine. This mine was laid from the air only and, as no parachute was required, it could be used to bomb with accuracy. The most popular magnetic mine towards the close of the war was known as type "O". It was a moored magnetic mine with a charge of approximately 750 lb. (Fig. 9).

The "O" type mine was spherical shaped and could be laid either from surface craft or from special mine-laying U-boats. The Germans did not always use the conventional mines. Some mine cases were adaptable to either a magnetic or acoustic unit and the units themselves could be either red or blue or

Fig. 9—Type "O" German magnetic mine.

bi-polar (red and blue). Different magnetic units could be fitted having a large variety of sensitivities and PDM actuations. Different types of mines were laid in the same field and magnetic and acoustic mines were quite frequently mixed together, making the task of minesweeping a most difficult and hazardous duty.

Magnetic Mine Sweeping

The first Royal Navy method of sweeping magnetic mines was called the magnet-spar sweep and consisted of six bar magnets attached to a 25-ft. spar, so arranged that they were towed along at a predetermined distance above the sea bed. This sweep was clumsy and ineffective and soon gave way to the coil skid sweep which consisted of a coil of wire towed behind the sweep vessel on a small scow or skid. The current in the coil could be reversed to sweep either red or blue mines. The mine detonated under the coil skid, which was frequently damaged, but at sufficient distance astern so as not to endanger the towing vessel.

Another method used without much success was an energized coil or cable attached to a slow flying plane which skimmed across the surface of the ocean. All these methods were only used temporarily and were soon replaced by the LL magnetic sweep, which is the present-day method of sweeping mines.

The LL sweep derives its magnetic field from the heavy current flowing through a single conductor cable which floats on the surface of the water and is towed in a straight line directly astern of the mine sweeper. When first introduced by the Royal Navy, the sweep was energized by batteries, but in later models of this sweep, the source of supply is an impulse generator. The floating cables are generally referred to as tails, of which there are two behind each sweeper, a short and a long tail. At the end of each tail there is an electrode which enables the current to enter the salt water. The complete LL circuit consists of the source of power (either batteries with charging generators or an impulse generator), reversing switch, connection box for the tails at the stern, short tail, electrode, salt water, electrode, long tail and back to connection box. The salt water forms approximately 50 per cent of the circuit resistance in order to change the polarity of the sweep, heavy disconnects are provided to reverse the current.

The short tail is married to the long tail throughout its length by rope bindings about every six feet. This is of great importance to the safety of the ship as the current in the two tails are in opposite directions and where the cables are bound tightly together, they neutralize one another. This means that the actual sweeping field commences the length of the short tail astern of the sweeper and extends to the end of the long tail. The construction of the buoyant cable itself has been described previously.

The towing strain of the cable is taken by two braided wire stockings connected to two pendants at the stern. The ends of the cables receive rough usage around the stern of the ship, particularly at the wire stockings, so to lengthen their life, the usual cellular rubber blocks are replaced with wooden blocks for the first 50 ft.

The magnetic tails are stored on a reel where possible, otherwise they are flaked out on the deck. The reels in smaller sweepers are on deck, while on larger ships, they are quite often kept below decks, the cable being fed down to the reel through the deck. In larger ships, power operated reels are installed, while in the smaller ones the cables are either recovered by hand or a hand-operated reel is installed. Care must be taken not to scratch or cut the surface of the cable. Small holes soon become large, due to the leakage current, allowing water to enter the cable. The cable is inspected carefully after each sweep and all holes or scratches are wrapped with rubber tape and painted with glyptal. Periodically the tails are taken off the ship and given a megger test ashore. This discloses all the small cuts which cannot be detected visually. The life of a set of tails varies from six months to a year, depending on the treatment received. They are not generally damaged by the detonation of a mine, but occasionally the cable is severed. As the tails extend a considerable distance astern, it is not an uncommon occurrence for a ship to run over them. This generally results in a crushed section of cable or other damage and necessitates a splice or a new section put in.

The mechanism of the magnetic mine unit is such that it would be useless to maintain a steady magnetic field, even if it were practical to supply the tremendous power required. A series of pulses are carried out, the period of cycle of which, combined with the speed of the ships, assures that the entire area between ships is covered with the field, that is, that the pulses of the same polarity overlap.

Double pulsing is the usual method of sweeping, meaning that the ship pulses red and blue alternately and that the entire swept area between ships is covered both red and blue during one passage of the sweeper.

Two or more magnetic sweepers generally operate together as this gives a much more efficient sweep. The fields of each sweeper combine to give a rectangular-shaped sweep, the width of which is considered to be the distance between ships. In order that the fields will be cumulative, the two ships must be of opposite polarity and both pulsing at the same instance. This is arranged through polarity lamps on each ship which flash on as the ships pulse, indicating whether the field of the ship is blue to starboard or red to starboard. One ship assumes the role of master ship and the other is called the slave ship and keeps in synchronism with it. This may be done automatically with "slave gear" or by hand using a mechanical or electric clock, the speed of which is controlled from the bridge. It is important that the ships be accurately synchronized otherwise the efficiency of the sweep is considerably reduced.

There are several types of slave gear which involve sensitive relays, amplifying tubes and switching apparatus controlling the main disconnects. The tails of the slave ship are cut by the potential gradient set up by the tails of the master ship. This induces about .4 volts across the tail terminals which is picked up and amplified to operate the control gear on the slave ship.

In sweeping magnetic mines, using the LL sweep, the ship precedes the sweep and must pass over the mine before detonating it. It is therefore most imperative that all magnetic sweepers have as small a magnetic field as possible and for this reason the most effective magnetic sweeper is a small ship of wooden construction. Magnetic sweepers are sometimes fitted with "A" coils and may have additional small degaussing coils to further reduce their field. Great care must be taken in installing electrical circuits to eliminate any stray field and the battery connections in magnetic sweepers of this type must be carefully studied out. It is sometimes necessary to install a degaussing coil to reduce these stray fields.

HOUSING PROBLEMS AND HOW HOUSING ENTERPRISES IS SOLVING THEM (*Continued from page 4*)

ment with the Government preference must be given to (a) ex-service men with annual income not exceeding 60 per cent of the cost of the dwelling unit, or approximately $3,000; (b) ex-service men of higher incomes, but equally desperate in their search for homes; and (c) civilians whose total family income does not exceed five times the rent. From every indication there will be many more veterans from (a) alone than there are dwellings to rent, so, for the present, civilians are out of luck.

As a guide to selection among veterans a " point " system has been devised. Points are allotted for length and nature of service, size of family, and for existing need in terms of present accommodation, such as over-crowding, necessity to commute to work, broken homes, unhealthy or sub-standard quarters, or excessive rentals. Without regard to the point system special consideration is given to veterans suffering from disability or ill health. Yet shelter must not go to waste through the renting of a larger house to a childless couple. On the other hand families of six or seven cannot be permitted in a small house.

Improved Techniques Constantly Being Sought

Realizing that house building today is old fashioned and inefficient, Housing Enterprises has done some research, by substitution of certain materials for those more conventional but unobtainable, such as aluminum sheet for vitrified flue lining, and by trial of certain new and experimental construction methods. But wholesale modernization of house-building, in both methods and materials, is a pressing need. Housing Enterprises, one of the few large-scale building organizations in Canada, provides such an excellent field for experimentation that it is a " natural " to pioneer the coming revolution. The cautious, conservative guidance of the insurance companies should ensure against going too far off the rails as most revolutionaries do!

What might have been done to accelerate construction of housing in the present emergency is a measure of what must be done even yet, namely the withdrawal of materials for priority housing from the production stream at the source, on the basis of forecasts of the requirements by quantities, rate of flow, and geographical destination. Machinery to effect such an orderly distribution is fortunately now being formulated at Ottawa, with the earnest co-operation of the priority housing agencies chiefly concerned, including Housing Enterprises.

The development of industrial processes in house-building should also be pressed, to replace its unit-by-unit method and emphasis on hand operations. Such development would be helped by encouragement of large organizations and greater use of machinery and of parts factory-produced to standard specifications. A more basic change, though one not readily practicable for the Government to launch as an emergency measure, is the elimination or modification of the involved sub-contracting system. One hundred per cent co-ordination and efficiency seem unattainable so long as the materials, labour and assembly of the parts of a structure are controlled by several independent groups.

Final Solution Not Yet Reached

Such developments would undoubtedly speed the production of houses, but they are not a total solution of the problem, since they leave untouched the provision of rental housing for the low income group, which constitutes at least one third of the population. In normal times low rental housing, often of equally low or lower calibre, came from 7th or 8th-hand occupancy of houses. Today, with our emergency rent control and eviction freeze, excellent as they have been for their purpose, this source is closed. New low rental housing may be created by building shacks without any of the amenities, but this is unsound from the national health point of view, and because such building rapidly degenerates into unprofitable slums. Our family allowances legislation is an attempt, only partially successful, to raise incomes to meet the costs of decent living, but expansion of this provision to meet economic rents of new housing does not seem practicable.

Yet it remains an undeniable fact that no new housing of decent standards can be built today by any method, which at economic rents can provide shelter within the means of the low income group. The next few months should see the first few hundreds of Housing Enterprises dwelling units happily occupied. Let us look forward to the day when not a few hundreds only, but every Canadian who needs one, may secure a " home " worthy of the name.

UTILIZATION OF SYDNEY SLAGS FOR ENGINEERING AND AGRICULTURE

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A paper delivered at the 1946 Maritime Professional Meeting of The Engineering Institute of Canada, The Pines, Digby, N.S., September 6, 1946.

The use of Sydney blast furnace slag for railroad ballast, road building, insulation, aggregate, etc., its possible use in cement manufacture, in making light concrete, and as a soil conditioner are discussed.

Their lime, phosphorus and magnesia content make Sydney open hearth slags valuable as soil conditioners and fertilizers. Researches by the Nova Scotia Agricultural Slag Committee in this field are described. Chemical treatment of run-off slag for recovery of phosphorus and vanadium is mentioned.

Large quantities of slag are produced in the making of blast furnace pig iron and in the making of open hearth steel at the Sydney plant of the Dominion Steel and Coal Corporation (Dosco). The production of slags at Sydney during 1944 amounted to some 320,000 tons of blast furnace slag and 146,000 tons of open hearth slag. The chemical compositions of the different slags are given in the accompanying table. The open hearth slag is of two general types—run-off slag and tapping slag. The run-off slag runs out of the front doors of the furnace early in the working of the heat and generally shortly after the hot metal addition. This slag flushes off a large proportion of the easily oxidizable elements and easily removable impurities. Following this, a second slag is built up for further refining of the bath. This and any later finishing slags necessary are generally referred to as tapping slags because they are run off at or about the time of tapping the finished steel from the furnace.

The bulk of the slag produced finds its way to dumps at the harbour edge or in nearby swamps. Many acres of slag-made land are found today where charts of forty-five years ago showed only deep water.

Disposal and utilization of slag has always been a problem and a challenge. Plants in congested areas such as Pittsburgh, find suitable dumping space scarce and may be forced to dispose of it by other means. In a highly industrialized district blast furnace slag may be disposed of profitably. Large quantities are used for railroad ballast, road building, roof covering, concrete aggregate, Portland cement making, insulating materials, soil conditioner, brick, sand for mortar, etc.

If the Sydney plant had been situated within a short rail or truck haul range of a city such as Montreal, slag dumps of such a size would never have existed. Due to its geographical position the movement of unprocessed slag has been limited to the local market, and the use of processed slag has not been uniformly successful. Sydney slag has nevertheless been adapted to different uses throughout the years, and the demand is rapidly increasing.

Blast Furnace Slag for Ballast and Roads

Normally the molten slag runs into large cast iron ladle cars hauled to the dumps by locomotive. It is this dumping which reddens the night skies and fixes the direction of Sydney for travellers and mariners many miles away. The cooled slag is an artificial cellular igneous rock. For most purposes it is removed by power shovel and then crushed and screened. For some purposes, such as for making cement and light weight concrete aggregate, special means of cooling the molten slag are employed.

Crushed blast furnace slag screened to $-2\frac{1}{2}$ in. $+\frac{1}{2}$ in. is very popular for railroad ballast. Its chief virtue is the excellent drainage it gives. It has also been claimed that the chemicals in the slag retard the rotting of the ties. Of recent years about 35,000 tons per year has been used for this purpose. Its use is limited only by the distance it can be hauled economically by rail.

Large tonnages of "run-of-shovel" slag are also used as filling material. During the war the expansion of the nearby airport at Reserve required huge quantities of slag for the filling of swamp land. Slag is always in demand for such purposes. The $-\frac{3}{4}$ in. $+\frac{1}{2}$ in. size is frequently used for cellar bottoms.

For road building, slag of about $-\frac{3}{4}$ in. $+\frac{1}{2}$ in. size is a satisfactory substitute for crushed rock. Although the slag is porous, engineers' handbooks claim it is hard and of high compressive strength. Hubbard(1) states that slag is especially adaptable for macadam roads. It has been widely used in the U.S.A. in macadamizing streets, airstrips, etc.

The $-\frac{3}{4}$ in. $+\frac{1}{2}$ in. size is very popular for driveways in the residential districts, the light colour of the slag making an attractive appearance. The $-\frac{1}{2}$ in. material is better for walkways and general beautification.

Slag Used for Insulation

During the last two years a new market has opened up for Sydney slag. With the current building boom the demand for rock wool for insulating purposes has greatly increased. The Elmac Company was formed in Saint John, N.B. for making this product from blast furnace slag and other materials. Recently this company moved to Amherst, N.S., where they have set up a larger permanent plant which is already nearing capacity operation.

The general method is to charge lump slag ($2\frac{1}{2}$ to $3\frac{1}{2}$ in. size) into a cupola with enough sand, sandstone or siliceous material to give a melted slag of the desired fluidity. The molten slag is tapped out at high temperature and atomized by a stream of high pressure steam or air directed at right angles to the slag stream.

Fig. 1—Blast furnace slag—cooled naturally. Crushed and screened to ($-2\frac{1}{2}''+\frac{1}{2}''$). Railroad ballast size.

The fine "wool" produced is caught in a "cage" and conveyed away from the jet. The finished rock wool is said to be second to none in quality for insulation. One of the early difficulties was its shot-iron content, but this has been overcome by selection of the slag and the installation of a strong magnet at the crusher to remove slag of high metal content. About 5000 tons of slag is now used for this purpose annually and consumption is expected to increase soon to 25,000 tons. The heat and sound insulating properties of mineral wools are well known.

Slag for Concrete Aggregate

Due to the abundance of beach sand and gravel, slag has not been used widely for aggregates in the Sydney district. Yet authorities claim that slag, offering as it does a rough pitted surface for the adhesion of cement, produces a very strong concrete. At the same time they caution that the slag should be low in sulphur content if the concrete is to be durable. Where slag has been used for concrete aggregate in Sydney no complaints have arisen. Inhibitions to its use for this purpose may be overcome by proper tests and demonstration. Hubbard(1) states that strengths, both compressive and flexural, developed in slag concrete are at least equal to those resulting from the use of other types of aggregate.

Foamed Slag for Light Weight Concrete

Recently, enquiries concerning foamed slag for light weight concrete aggregate have been received. Foamed slag is produced by pouring molten slag into a relatively smaller volume of water, whereupon the water is largely converted to steam before the slag loses its plastic condition; the expanding steam fluffs the slag up into a foam, which solidifies almost immediately. This foamed slag is very cellular and light. The crushed and screened material from a number of tests varied in weight from 21 to 33 lbs. per cu. ft. depending on size as compared with slag from the dump weighing from 60 to 75 lbs.

It is quite possible that, by careful control, an even lighter material could be produced. Correspondence on foamed slag between British experts and the Nova Scotia Department of Industry has shown that the

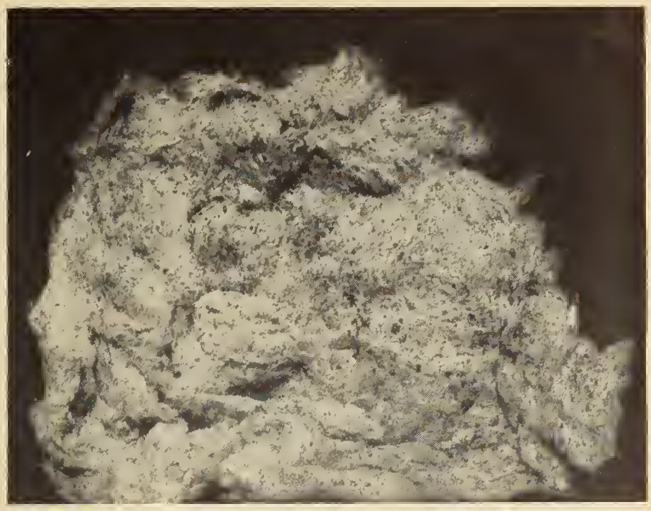

Fig. 2—Mineral wool insulation made from slag. "Loose" wool—unrefined.

chemical composition of Sydney slag is suitable for this purpose. Special Report No. 19 of the (British) Iron and Steel Institute by T. W. Parker(3) deals with a study of the suitability of this slag as a light weight aggregate. Foaming stabilizes the slag and prevents the phenomenon of "falling" found with certain compositions. Foamed slag is not intrinsically corrosive to steel. The protection afforded to steel however by light weight concrete, whether of foamed slag or other light weight aggregate, is not so complete as that given by heavy aggregate. The concretes examined showed higher strengths than those made from other light weight aggregates. Such properties as thermal insulation, moisture movement, ease of plastering, etc., were comparable with other types.

Slag for Making Building Cement

Slag cement, made by grinding slag and slaked lime together in the proper proportions, has been used in Europe for many years.

TABLE I

Chemical Composition of Sydney Slags

	Symbol	Blast Furnace	Open Hearth	
			Run-Off	Tapping
Calcium oxide	CaO	50.0	21.0	50.0
Phosphoric anhydride	P_2O_5	—	11.0	10.0
Magnesia	MgO	3.75	3.6	7.5
Silica	SiO_2	31.0	23.5	12.5
Alumina	Al_2O_3	14.0	3.0	2.0
Iron oxide	FeO	0.30	32.0	11.5
Manganese oxide	MnO	0.16	2.9	5.8
Vanadium pentoxide	V_2O_5	Nil	0.9	0.2
Titanium dioxide	TiO_2	0.40	—	—
Sulphur	S	2.50	—	—

Fig. 3—"Foamed" blast furnace slag. For light weight concrete aggregate. Crushed and screened to $-1/8''$ size.

A plant operated for several years in Sydney at two different periods, and produced both slag cement and slag brick. The bricks were made from granulated slag bound with slaked lime. Although the slag cement was a satisfactory building material, it was not as popular as regular Portland cement due to its slow setting. When Portland cement became plentiful and cheap again after 1918 local demand fell and freight haul to large centres was high, hence the company went out of business. Since that time, addition agents to improve setting properties have been developed and there are possibilities for reviving this business. The bricks produced at this plant were widely used for building construction around Sydney. When well wetted down before use they are said to be the equal of any brick.

In 1892, Albrect Stein and Company in Germany perfected a process for producing a Portland cement clinker by calcining slag and limestone together. This clinker, when mixed with further additions of unburned blast furnace slag, was ground into cement. The cement was used in Germany for public works construction. Variations of this process have been used all over the world. Companies employing slag in Portland cement manufacture accounted for some 8 per cent of the U.S. output in 1935. This process has never been tried at Sydney.

Slag for Agricultural Purposes

A review of literature on slag used in agriculture, by F. E. Lathe(2) disclosed that it generally is the equal of limestone as a soil acid neutralizer, on account of its high lime and magnesia content. As about 100,000 tons of agricultural limestone are used yearly in the Maritimes, and as the demand will more than double in the not distant future, it can be seen that slag has possibilities in this field. Laboratory tests by Dr. G. R. Smith, provincial chemist for Nova Scotia and his assistant, Mr. B. Coldwell, show that Sydney slag has a neutralizing value equal to limestone. Pot tests are now in progress at the Dominion Experimental Farm at Kentville under the direction of Mr. A. Kelsall. These will reveal the true value of slag as a soil neutralizer and conditioner. This slag should be suitable for neutralizing or sweetening any acid waste or acid producing waste.

Large amounts of slag are also used in the U.S.A. for trickling and sprinkling filter beds, for roofing purposes, for making asphalt shingles and glass making.

Fig. 4—Granulated open hearth tapping slag. At left—as granulated, coarse. At right—as ground to 80% minus mesh. For agricultural use.

Open Hearth Slags for Fertilizer

In normal plant operation, the open hearth slags are allowed to solidify in slag boxes and ladles from which they are dumped when cool. They freeze to a hard igneous rocklike mass, the run-off slag nearly black, the tapping slag brown to dark brown. Blast furnace slags are light gray to white.

Slags from both Bessemer and open hearth processes have been used in agriculture for fertilizers and soil conditioners for many years and their value is established beyond all doubt. Slags contain phosphorus, lime, magnesia, manganese and other elements necessary to plant growth. Phosphorus, one of the all important N—P—K trio, has generally been the basis of evaluation. A figure of close to 20 per cent phosphoric anhydride has been reached by some slags.

Slag produced from the Bessemer process has been most generally used because the process is conducive to concentrating the oxidized phosphorus into a relatively small slag volume, and to leaving the phosphoric anhydride bound loosely enough to have a rapid availability for plant nutrition when the slag is ground to the 80% minus mesh standard. Open hearth slags are also used where the phosphoric acid content is high enough and where its availability as shown by the citric acid test is sufficient.

The relatively high phosphorus content of the Wabana ore used at Sydney made it inevitable that much consideration would be given to possibilities of use for Sydney steelmaking slags in agriculture. After installation of Bessemer converters at Sydney for duplexing, the Cross Fertilizer Company produced a good grade of Bessemer slag. Eventually the Bessemer Duplex process was abandoned in favour of the present open hearth process of steelmaking, which produced a slag containing 10-11 per cent phosphoric anhydride as against about 16 per cent for Bessemer slag. A good grade of Belgian Bessemer slag was then being imported and sold very cheaply. The Cross Company could not meet this competition and went out of business, because availability of phosphorus in the new slag was low, its lime value was not recognized and grinding and bagging costs were high. Improvements in grinding equipment and the invention of the paper bagging machine have changed part of the picture. But someone had still to find a means of raising the availability of the phosphorus and to test the actual value of the lime content of the slag and its nutritive elements.

Tapping Slag as a Soil Conditioner, etc.

Attempts have often been made to increase the availability of the phosphoric acid in the slag and evaluate it by agricultural experiments, and enough encouragement has been received to point to the feasibility of a real research and development job being done.

In December 1943, a committee was formed from various representatives of government, government technical and research bodies, Dosco technical staff etc., under the chairmanship of Dr. J. R. Smith, provincial chemist at Truro, with metallurgical subcommittee chaired by Dr. A. E. Cameron, Deputy Minister of Mines, and agricultural subcommittee under Mr. A. Kelsall of Kentville Experimental Station.

This committee has proved a model of co-operation and energy since its inception. It was found that granulation of both run-off and tapping slags in water greatly increased the availability of phosphoric acid. Although the run-off slag responded more readily than tapping slag in this respect, the committee chose to concentrate on the tapping slag because its granulation

(Continued on page 22)

FUEL OIL FOR INDUSTRIAL BOILERS AND HIGH HEAT COMBUSTION CHAMBERS

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A paper presented before the Montreal Branch of The Engineering Institute of Canada, March 28, 1946.

The author analyzes various types of liquid fuel, discusses atomizers, pumps and heaters with the aid of illustrations, and adds a generous measure of helpful hints for their use based on long and varied operating experience.

There are two outstanding types of petroleum; one with a paraffin base and the other with an asphalt base. The asphalt base type is dark coloured, has high viscosity, and generally contains more sulphur than the paraffin base type. The paraffin base crudes are almost wholly used for producing lubricants and little, if any, finds its way into the boiler fuel field. While the two types of crude are outstanding, there is considerable of a mixed base type containing both paraffin and asphaltum. Distillation and cracking processes, to obtain the maximum yield of the lighter fractions, have resulted in heavy residues which, under some conditions, must be blended with less viscous oils to produce a marketable product.

Petroleum consists almost entirely of carbon and hydrogen, with small quantities of oxygen, nitrogen and sulphur. Generally, the proportion of these elements is about as follows; carbon 80 to 87 percent, hydrogen 12 to 15 per cent, oxygen, nitrogen and sulphur, 0.1 to 7 per cent. All natural oils consist of mixtures of hydrocarbons belonging to various well recognized series, some of the principal ones being; paraffins—$C_n H_{2n+2}$, olefines—$C^n H_{2n}$, naphthenes—$n(CH)_2$, benzenes or aromatic—$C^n H_{2n-6}$.

The sulphur in petroleum seldom exceeds one per cent, but over two per cent occurs in many oils from the Gulf section of the States, and still higher quantities in some Mexican crudes. A high sulphur content, in the past, was considered objectionable on the ground of possible corrosion of metal by the combustion gases, but this has been found to be insignificant except where condensation can occur and sulphur acids are formed.

The use of liquid fuel has many advantages over coal for steam generation, for example, it has higher calorific value, namely 18500 B.T.U. per pound of liquid fuel as compared with 13500 B.T.U. per pound of coal. Liquid fuel has a bulk storage value of 38 as compared with 43 cu. ft. per ton for coal, which permits a greater number of heat units to be stored per unit space in the ratio of about 1.5 to 1.

In confined spaces, oil can be stored in tanks below ground, or remote from the location where it is to be used, due to the ease with which it can be handled over long distances. Liquid fuel will not deteriorate in storage. Its use is usually accompanied by a reduction in operating staff, while maintenance of firing equipment and boilers is usually less with oil than with coal. Moreover, the elimination of ash, with the attendant expense of handling and disposal, is avoided. Coal users seldom consider the transportation cost of the ash and moisture in their fuel.

The location of oil storage facilities, above or below ground, their size, etc., depends upon local conditions and requirements. If tanks are buried they should be at least 2 ft. below grade and, if necessary, protected with a concrete slab extending beyond the tank in all directions. Because of their corrosive effect, cinders should not be used as back fill. Welded construction is recommended, and a careful hydrostatic test is essential prior to back filling after the tank is set in its final position on saddles. The metal surfaces should be well protected with a heavy coating of asphaltum or bitumastic paint to prevent corrosion.

If the location presents a possibility of the tank floating when empty, it should be securely anchored to a concrete slab to offset its buoyancy. All pipe connections should be arranged with sufficient flexibility, to preclude strains which would accompany any settling of the tank that might occur. Access manhole openings should be provided for inspection, cleaning and repairs.

The boilers for which oil firing equipment is furnished embrace the wide diversity of size and type with which all are familiar. Each lays claim to some special merit for its design, and for the particular service in which it is to be used.

The various types of atomizers available for firing these boilers are; the straight pressure or mechanical atomizer, with or without the addition of return flow system bleeding oil from the discharge orifice, to increase the range of capacity; the rotary spinning cup atomizer type; and the steam atomizer type.

The pressure atomizers are always used in conjunction with air admission registers. The rotary spinning cup is sometimes installed in a register, but more frequently the combustion air is admitted through an opening in the furnace front below the atomizer. It may also be admitted through a checkered arrangement of ports in the refractory furnace floor. The steam atomizer is usually installed with the checkered floor, but a few have been used with registers.

Each of the foregoing methods has its own points of advantage. The basic reasons for the several methods are that the straight pressure or so called mechanical atomizer is undoubtedly the simplest as the supply pump is the only moving unit on the system. It uses an atomizer having a fixed orifice and is the most efficient for plants with fairly uniform steady operating loads. Without making a change in sprayer plate size, the range of operation is limited to that which can be

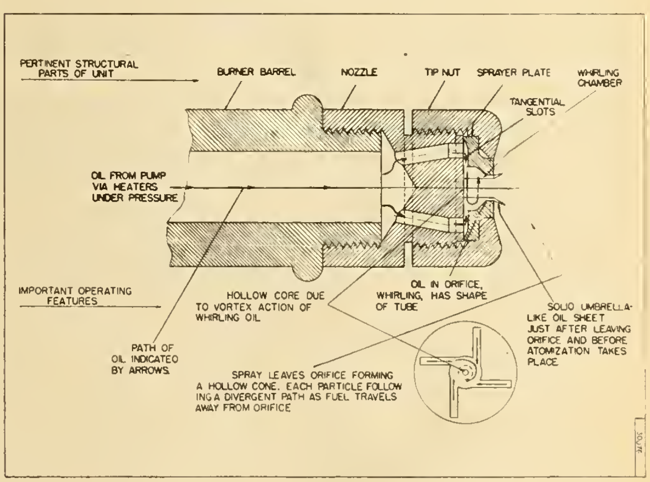

Fig. 1—Section through pressure atomizer.

obtained by varying the supply pressure which is approximately 2 to 1. If the installation is operated by an automatic combustion control, it must be reset for each sprayer plate change. While these changes and readjustments can be made quickly, they always require the service of an attendant. The oil must be delivered at uniform temperature and steady pressure, which pressure can be varied manually or automatically to meet changes in load demands. The temperature should be equivalent to that which is required to effect an oil viscosity of 150 S.S.U.

Atomization by pressure is sometimes known as dynamic pulverization, since the energy imparted to the oil by the fuel-oil pumps in the form of pressure is converted, in the final stage of the atomizer, into a velocity force which projects each oil particle in a diverging path, thereby breaking up the solid mass into minute particles. This energy must overcome the fuel-oil surface tension, the viscosity forces which tend to hold the mass together, the friction of the atomizer and the resistance of the gas in the furnace to penetration. It is therefore obvious that the ability of the atomizer to counteract these resistances will depend on the amount of energy supplied, and that the size of the atomized particle will be reduced as the pressure is increased.

Figure 1 shows the working end of a successful and efficient fuel-oil atomizer, in use at the present time. The path of the oil flow is shown by arrows. Conventional names of the pertinent parts are indicated together with notes bringing out the important operating

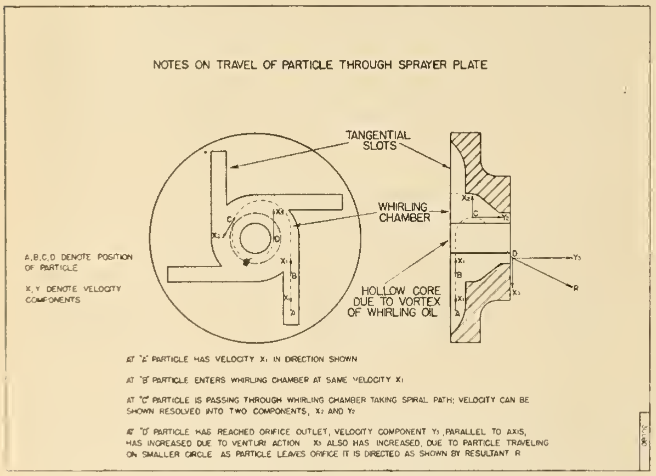

Fig. 2—Sprayer plate.

features. This figure is shown in lieu of a verbal description, as it depicts what actually takes place in the atomization of fuel.

Figure 2 shows an enlarged view of the sprayer plate of this unit, indicating the various dynamic forces and velocities as they occur, and their effect on a particle of oil passing through the atomizer.

In general, it can be stated that pressure atomization consists of forcing oil under pressure through a series of passages designed to develop rapid rotation. The centrifugal force thus obtained causes the oil to emerge from the atomizer orifice and enter the combustion chamber in the form of a hollow conical spray.

The quality of atomization for any atomizer design is primarily dependent on the delivery pressure. This is because the dynamic energy imparted to the oil must be of sufficient magnitude to rend the oil into minute particles as it leaves the confining walls of the atomizer orifice.

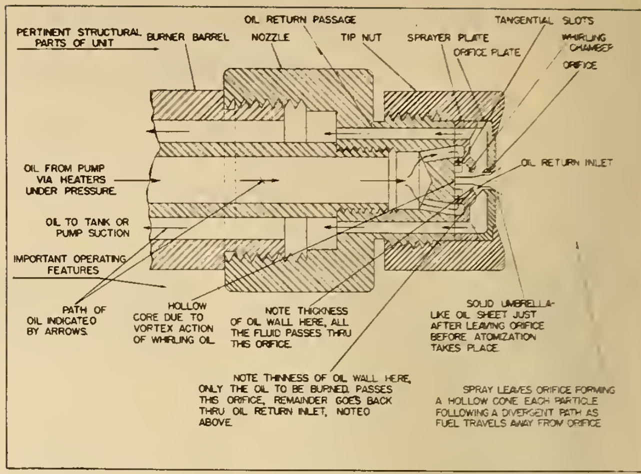

Fig. 3—Section of variable-capacity fuel oil atomizer.

The design of the present-day pressure atomizer used by leading manufacturers has reached an extremely high state of development, as regards the quality of atomization. But it has one serious drawback; namely, a very limited operating range, without recourse to a manual change in the size of the atomizer orifice.

Figure 3 shows the construction features of the variable-capacity atomizer. It is comparable to Fig. 1 which shows the construction features of the ordinary pressure atomizer.

This type, called the variable capacity—"Vee-Cee" atomizer, uses a fixed sprayer orifice with the addition of a bleed off which provides a return flow back to storage or pump suction. This materially increases the operating range and without the necessity of changing sprayer plates a range of 6/1 and greater can be provided. Supply pressure and temperature are maintained constant, and the range is controlled by varying the quantity bled away from the atomizer through the return line. A plurality of burners and boilers can be handled by one master valve in a single return connected to all burners. It is most efficient for plants with widely fluctuating loads and exceptionally well adapted for use with a combustion control system. This is because one sprayer plate size can cover a wide range of capacity, and because after system is once adjusted, it requires no further resetting. The oil must be delivered at constant pressure—300 lb. per sq. in. minimum—and temperature equivalent to viscosity of 100 S.S.U.

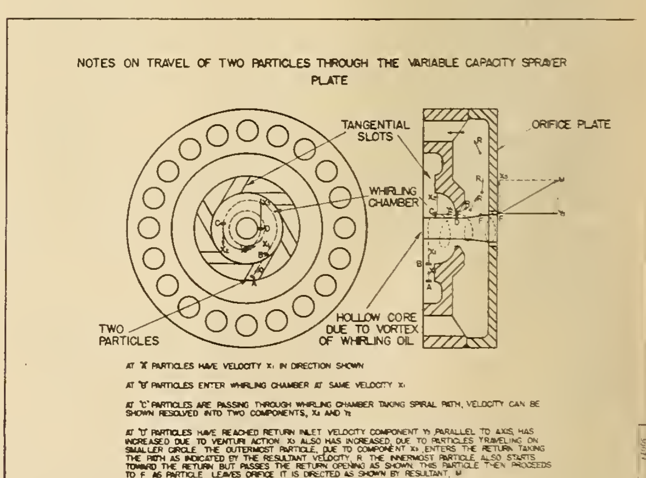

Fig. 4—Forces and velocities in variable capacity atomizer. Compare with Fig. 2.

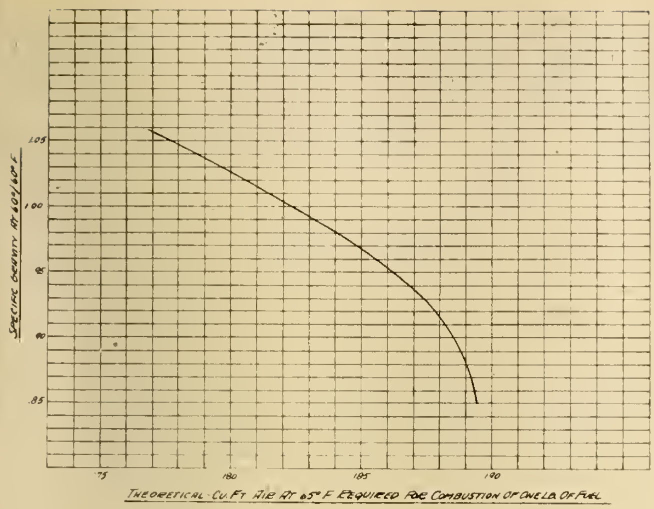

Fig. 5.

The design shown in Fig. 3 consists structurally of the same members as the ordinary atomizer, except for an additional passage to return unused oil and a separate atomizer orifice plate. The sprayer and orifice plates are centered in the burner nut, the orifices being of the same diameter and in alinement.

The orifice plate is made dome-like to provide an annular space in the orifice for the oil to return as it leaves the whirling chamber. The return passage is made by placing a large tube on the outside of the supply tube. The inner or supply tube carries the fuel oil to the sprayer plate, while the annular space between the inner and outer tubes provides a return-flow passage. Oil under pressure is delivered through the inner tube to the annulus surrounding the whirling chamber, from which it passes into the whirling chamber through a series of slots.

Since these slots are tangent to the whirling chamber side wall, the oil rotates in this section of the sprayer plate. It follows a spiral path as it progresses toward the outlet orifices. Entering these orifices, the pressure parallel to the axis of the sprayer plate, forcing the fluid outward, has been converted into velocity in the same direction. This is due to the venturi action of the whirling chamber and its orifice. At the same time, after leaving the tangential slots, the whirling oil sets up a definite centrifugal pressure perpendicular to the axis of the sprayer plate.

As the rotating mass reaches the return annulus, the quantity of oil which is being by-passed will be forced into this opening by the centrifugal force. This is because there is no static pressure, it having been converted into velocity parallel with the sprayer-plate axis. The oil on the inner wall of the vortex, due to its centrifugal force, moves to a position nearer the side wall of the orifice previously occupied by the by-passed oil. This oil then leaves the confining walls of the orifice with its energy undiminished, and atomization takes place.

The quantity of oil by-passed is a function of the return pressure. If the return-line valve is closed, a pressure gage placed in the line ahead of this valve will show the pressure in the orifice. As the return-line valve is opened, this pressure will drop and the quantity returned will be proportionately increased, since the centrifugal force is transferred into velocity in the by-passed oil.

Theoretically and practically the quality of atomization for this variable-capacity atomizer is constant over the entire range as described above. All oil passing the sprayer plate is given the energy required for proper

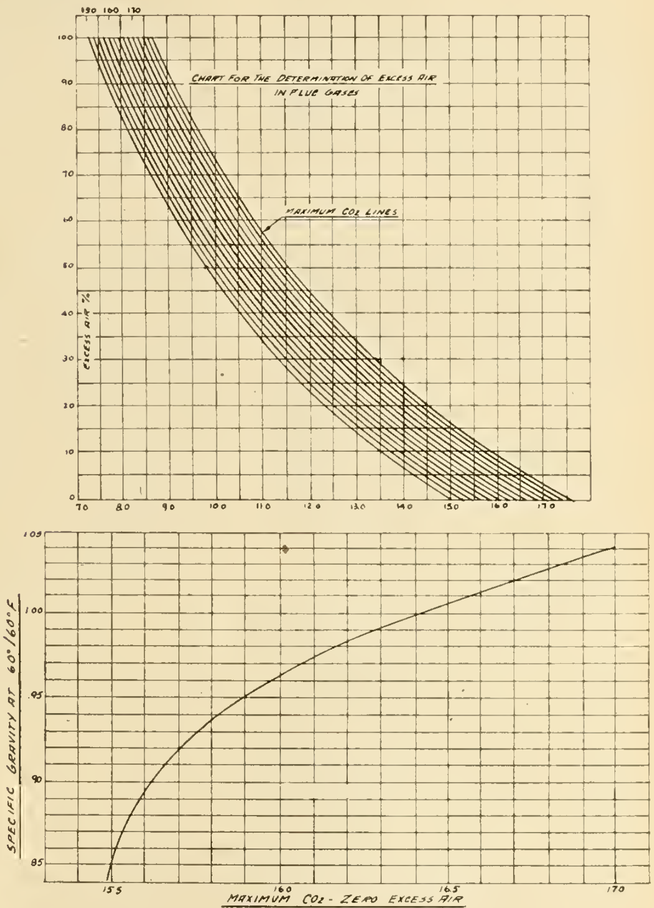

Fig. 6.

TABLE I

Burner Clearances—Minimum Dimensions

Firing Rate—Lbs. Hr. Burner	750.	1500.	3000.
Centerline Burner to Refractory Floors	24″	27″	32″
Centerline Burner to Refractory Walls	27″	30″	36″
Centerline Burner to Water Wall Tubes	27″	30″	36″
Centerline Burner to Steam Generating Tubes	30″	33″	38″
Centerline Burner to Shell—HRT Boilers	42″	48″	—

atomization by means of the constant supply pressure.

The rotary spinning cup type is generally used on boilers where operating pressure is 15 lb. per sq. in. or less, because it can atomize the heavier fuels at higher viscosities than either of the pressure types. As already stated, the straight pressure atomizer requires 150 SSU. Optimum for the return flow is 100 SSU, while the rotary can operate with the same fuel at 375 SSU. This means that on low pressure installations where the steam temperature is insufficient to provide fuel at high temperatures the rotary type can be used effectively. It is not as efficient, however, as either of the foregoing, and as each burner is motor-driven, mechanical failures are ever present. Yet it has a wide range of capacity and is readily adaptable to handle Bunker "C" oil automatically when provided with gas ignition.

The use of the steam atomizer is indicated where heavy tars, sludges and other by products are used, which require atomizers with generous port areas to preclude clogging. The viscosity is not usually required to be below 375 SSU, and the supply pressure about 100 lb. per sq. in. Combustion control can be readily applied. The main drawback is the continual use of steam for atomization.

From the foregoing it is apparent that:

①For a plant with steady load, with slight fluctuations, and using Bunker "C" oil,—the most efficient and simplest installation is the straight pressure atomizer.

②For a plant under conditions as above, but with widely fluctuating load, return flow atomizers are preferable.

③For low pressure plants, rotary atomizers are best.

④For a plant using by product waste fuels, where the use of steam for atomization can be afforded—steam atomizers should be used.

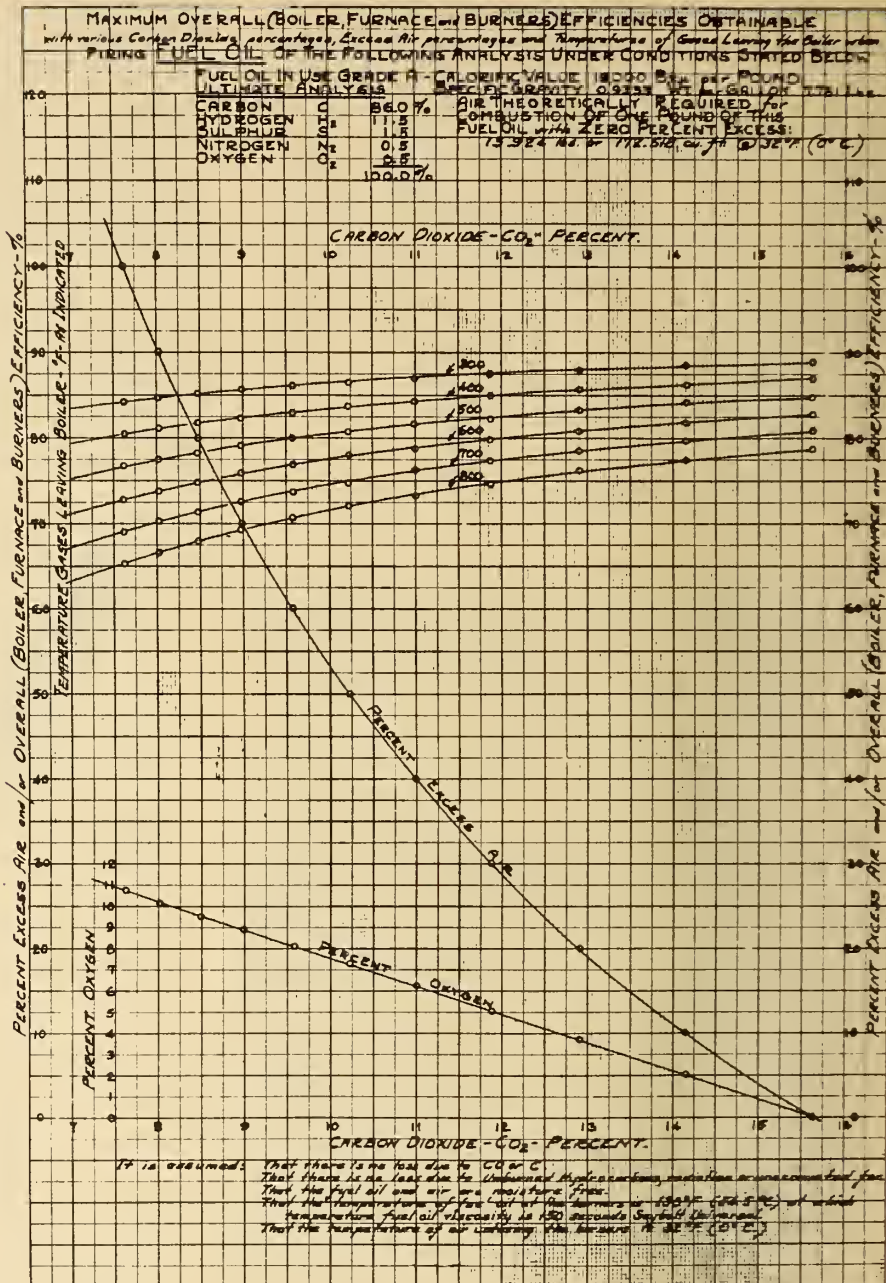

Fig. 7.

As previously stated, pressure type atomizers require the use of air admission registers, and all types are most effective when used with them. These registers are built in a range of sizes and their capacity depends on the draft available. Capacity can be closely approximated from the following:

Knowing the gravity of fuel, the theoretical volume of air required for combustion of one pound can be determined from the curve in Fig. 5. The draft loss in inches of water across a register is then:

$$D_L = \left(\frac{Q \times F \times T_{abs}}{A \times K \times 525 \times 956 \times \sqrt{\dfrac{T_{abs}}{B}}} \right)^2$$

Q = Lb. fuel burned/min.

F = Cu. ft. air required/lb. fuel $\times$ % excess air used.

A = Area of register throat in square feet.

B = Barometric pressure.

K = Coefficient which varies with type of register and number installed on a boiler. This is usually determined by the manufacturer by test.

If the coefficient "K" and the furnace draft available are known, the maximum capacity of a register can be estimated operating under natural draft. This establishes the number of burners required to meet the load requirement. By use of table of clearances, as shown in Table I, a check can be made to determine if space available on boiler front is sufficient to provide for their installation.

If the available draft is insufficient, forced draft, induced draft, or a combination of the two must be provided—artificial draft is quite common in present day practice due to the higher ratings at which boilers are fired, and has the advantage of being more positive and easier to handle than natural draft.

Furnace volume is somewhat indeterminate, as the

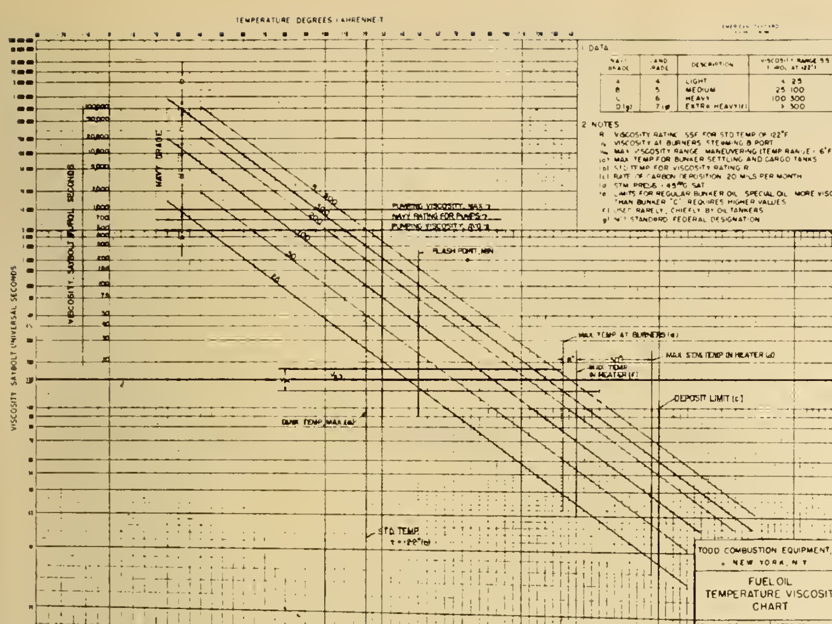

Fig. 8.

The curve, in Fig. 6 gives a ready check on this item, while, Fig 7, shows the approximate equivalent boiler efficiency under the conditions as stated thereon.

In order to obtain uniformity of atomization and firing rate it is necessary to maintain the viscosity previously mentioned for the different types of atomizers. The chart on Fig. 8, gives temperature required, and this should be held as close as possible. It also gives proper preheat for pumping. Most plants are not equipped with viscosimeters, and as viscosity has no relation to specific gravity, this must usually be obtained from the oil vendor.

Reciprocating pumps should be selected on basis that oil capacity is approximately 20 per cent of the water capacity. Duplex-double acting pumps are recommended. Due to slow speed and low rating, the steam and exhaust lines can be reduced at least one pipe size smaller than required for water. The reason for the reduction in piston speed is to give the oil a chance to fill up the cylinder, thereby maintaining a steadier discharged pressure. A pump that is under size or running too fast usually produces a wide fluctuation in supply line pressure, which is felt by the burners and creates a surge in the furnace.

To further steady the supply pressure and dampen the pressure changes due to pump strokes, an air chamber of generous proportions is recommended. This should be located between pump discharge and oil heater, and should be arranged with inlet and outlet connections so that oil enters and leaves it. If put on a line with only one connection off a tee branch its effectiveness is greatly reduced and at times nullified.

All steam pumps should have an adjustable pressure regulator on steam supply and a relief valve on discharge, set at 25 lb. per sq. in. above maximum operating pressure. The market affords many motor operated pumps, gear, screw and the like, some of which are excellent. When used these should be provided with readily adjustable relief valves for controlling pressure.

Heaters are available in many designs.—Those that can contaminate the boiler water by internal leaks should be avoided. The recommended type is that which has all joints external of the steam space. In making a selection, ease of cleaning, either mechanical or by solvent, should be given consideration.

Strainers should always be of the duplex type, properly valved so they can be cleaned without interrupting operation. One should be installed on the suction line ahead of the pumps. This should have openings not over .060 in. dia. Another should be installed on the discharge line after the heaters, so it will be handling heated oil, and should have openings of .030 in. dia. Piping should be sized so that the velocity in the suction to the fuel pumps is not over 40 ft. per minute, and in the supply line to the burners 120 ft. per minute.

The need for large quantities of high temperature gas at various pressures, for process work and in gas turbines, has resulted in the development of an all-metal combustion chamber. These have been designed and operated in sizes ranging from 40 to 10,000 cu. ft. per min., and at pressures up to 90 lb. per sq. in. Outlet

relation between the total volume and that occupied by the flame body is not always favourable to accepting the total as useful volume. It is usual, if possible, to limit the heat release to 40,000 B.T.U. per hour, per cubic foot of total volume on boilers with refractory lined furnaces, in order to anticipate reasonable life of the linings. With air cooled walls this figure can be increased, and with water wall, boilers in naval service have operated continuously at 500,000 B.T.U. heat release. Although there is no need to approach this figure on shore installations, it is believed the volumes now used are far too conservative.

The efficiency of combustion is mainly related to the amount of excess air supplied to the burner. This should not exceed more than 25 per cent of that theoretically required. Many installations operate with 10 to 15 per cent and an efficient air admission register should produce intimate intermixture of air with the atomized fuel within these limits. The percentage of excess air can be determined by orsat analysis of the stack gases.

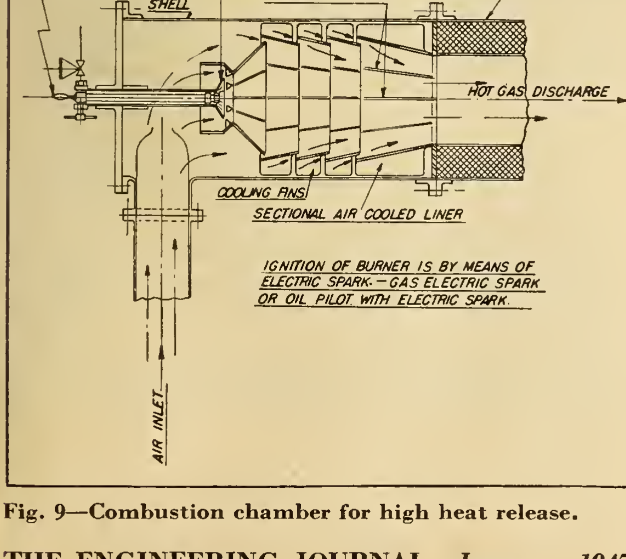

Fig. 9—Combustion chamber for high heat release.

temperatures of 1,800 deg. F. have been attained.

Heat releases up to 12,000,000 B.T.U. per cu. ft. per hr. of furnace volume have been reached. The chambers have been fired with straight pressure and return flow atomizers. The design provides for a portion of the air to enter the burner proper. The remainder enters the combustion space through the annular furnace liner openings, simultaneously cooling the liners. This secondary air provides additional oxygen to complete the combustion process or lower the outlet temperature by dilutions of the hot gases. Figure 9 shows a typical combustion chamber unit.

Originally this design of furnace was developed for gas turbines. However, during the war it was first applied to a device for generating screening fog. This was installed on most of our combatant vessels and later in a smaller size for portable units for use on shore. It has since been used to distribute insecticide by the aerosol method for mosquito control. Many other applications are pending. The use of the variable capacity type atomizer with these chambers provides the operator with ready control of outlet temperature over the full range of the chamber's capacity, without change in sprayer plate size.

UTILIZATION OF SYDNEY SLAGS FOR ENGINEERING AND AGRICULTURE

(*Continued from page 16*)

was practical under plant conditions. The quantity available was much larger than that of run-off slag, and its lime content, and consequent soil acid neutralizing value, was much higher.

A method of steam granulation was developed, whereby a stream of molten slag is broken up by a high pressure steam jet into a spray of globules, which are quenched in a tank of water. Experiments in 1944 showed that this increased the "availability" of the phosphoric acid (by the citric acid test) from about 16 per cent for air cooled slag, to 50 per cent for the steam granulated material, when both were ground to pass 100 mesh. Extensive greenhouse pot and plot tests were conducted at experimental farms, while full scale tests on many farms of various soil types were carried out, which showed that a ton of this slag was equivalent in value to about one ton of agricultural limestone plus 500 lb. of superphosphate.

It was long believed that the citric acid test for availability of phosphoric acid was not a fair means of gauging the true fertilizing value of the phosphoric acid in the slag, and that it only approximated the phosphorus available in the first crop year, and that the greater part of the remainder would become available over a period of years. Agricultural tests have confirmed this. In cases where "grain was sown to hay" on some forty Nova Scotia farms, the yield in hay in the second year from one ton of slag per acre was about 40 per cent above the check plots. Third year results are being compiled. All results confirm the belief that the greater part of even the so called "unavailable" phosphorus becomes available within a very few years.

This year a pilot plant was erected which can produce about four thousand tons of the steam granulated tapping slag per year. A small amount was produced this spring, chiefly for orchard tests in the Annapolis valley. Some believe it will improve the keeping quality of the apples as well as supply usual soil nutrients. Limited scale commercial production may soon commence. If the demand is encouraging, plant capacity will be greatly increased. This is welcome news to those concerned with the world fertilizer shortage.

Meanwhile, pilot plant experiments will be carried on in an effort to improve the slag still further. Past experiments have shown that fluorine content, fineness of granulation, rate of cooling, the P_2O_5/SiO_2 ratio, and fineness of grinding are all potent factors affecting phosphoric acid availability. Numerous points of interest and importance have been discovered through research by both the metallurgical and agricultural subcommittees. Some have been covered by published papers.(5) Others will be given in later papers dealing solely with this branch of slag utilization.

Run-off Slag as a Fertilizer

No practical means has yet been found for realizing the full potential phosphorus value of run-off slag. At the dump, however, it contains about 5 per cent available phosphoric acid, and 5 per cent of so-called unavailable phosphoric which probably would become available in the soil over a period of years.

Experiments not yet complete indicate that run-off slag can be mixed with ammonium sulphate without loss of ammonia, and will yield a remarkably free running mixture even when dampened. The addition of potassium chloride does not seem to change this behaviour. If subsequent experiments confirm this, it means that run-off slag may be successfully used as the phosphorus carrier in mixed fertilizers or, at least, as an active filler in mixing.

Extraction of Vanadium and Phosphorus

Along with the phosphorus, Sydney open hearth slag contains appreciable amounts of vanadium. Because of the shortage of vanadium for special steels during the war, the Dominion Government encouraged attempts to extract this valuable element. Both vanadium and phosphorus can be recovered by chemical means and, had the critical shortage not been alleviated, the development of the process would have continued. Without further research it would be impossible to say whether or not it could be done feasibly at peacetime prices.

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HYDRO-ELECTRIC PROGRESS IN CANADA DURING 1946

The annual review of hydro-electric progress in Canada prepared by the Dominion Water and Power Bureau, Department of Mines and Resources, Ottawa, discloses that, during 1946, the hydro-electric industry in Canada has made good progress in the transition to normal peacetime economy. The dislocations due to cessation of war demands have not proved to be as severe as were anticipated; growing domestic demands and the use of secondary power for steam generation have so largely absorbed a potential surplus that primary demand may exceed supply before new developments can be brought into operation.

Some temporary reductions in demand for primary power resulted from labour difficulties, particularly in Ontario. Production in central Ontario, eastern Quebec and the Maritimes was curtailed by low stream flow during late summer and early autumn. The output of electricity by central electric stations during the year continued at a high level; for the first ten months of 1946 total electrical production by central stations was 2.6 per cent higher than for the same periods of 1943, 1944 and 1945.

New installations coming into operation during the year were few in number totalling only 27,760 hp. At the year's end, a total capacity of over 400,000 hp. was under active construction across the Dominion and preliminary work or investigations were under way on projects involving an additional 600,000 hp.

British Columbia

Although two important hydro-electric developments are under active construction, no new installations were brought into operation during the year. The consumption of electrical energy for the year shows a rising trend, particularly in the Greater Vancouver area.

The British Columbia Power Commission made good progress on the first phase of its development on the Campbell River, Vancouver Island, consisting of two 25,000 hp. units; the first unit is expected to be brought into operation during 1947.

Construction of the British Columbia Electric Railway Company's Bridge River project has been proceeding according to schedule; work is being rushed on the diversion dam, and a beginning has been made on the 130-mile transmission line from Seton Lake to Vancouver. The company has an extensive expansion of its distribution facilities planned for 1947.

The Powell River Company has proceeded with the completion of the concrete variable radius arch dam on the Lois River for raising the present structure 20 ft. The installation of a second 18,000 kva. unit at Lois River is contemplated for 1947. Other smaller hydro-electric projects were under way or planned in various parts of the province.

Northwest Territories

The Department of Mines and Resources commenced construction of an 8,000 hp. development on the Snare River, about 90 miles northwest of Yellowknife which will supply power at cost to mines in the Yellowknife area. The development involves the construction of an earth-fill dam across the Snare River. An average head of 56 ft. will be created. A 110,000 volt transmission line is being built by Giant Yellowknife Gold Mines to transmit power to Yellowknife, the Dominion having the right to take over this line after completion. Present plans call for delivery of power in the fall of 1948.

Alberta and Saskatchewan

No new power projects have been completed or brought into operation in Alberta or Saskatchewan. The one project under construction is that of the Calgary Power Company at Barrier on the Kananaskis River, involving a single unit of 13,500 hp. under a head of 150 ft. The plant will supplement the peak capacity of the company's system; the water passed through the Barrier plant will provide additional power at the Kananaskis, Horseshoe and Ghost plants.

Manitoba

In the Slave Falls plant of the Winnipeg Hydro-Electric System, two new units of 12,000 hp. have been installed, one being now in operation. Work is under way for the completion of this plant by the addition of Units No. 7 and No. 8 during 1947. During the year, the Manitoba Power Commission carried out an extensive program of extending electric power to towns, small communities and farms. About 286 miles of transmission lines were built; extension of the "Farm Electrification Program" involving construction of 939 miles of transmission lines of all types, was carried out, and several new substations were added to the system.

The Winnipeg Electric Company completed a 13,000-volt transmission line to Goldbeam Mines. A new transformer bank of 30,000-kva. capacity was put into operation at the Fort Garry substations. At the Seven Sisters power house, preliminary work is under way to raise the head at the site to the final limit. Contracts for rock excavation in the tailrace and for the raising of the dykes are to be let before the end of the year.

In the northern mining area, the 43-mile transmission line from Sherridon to Snow Lake is expected to be completed early in 1947. This area is served from the Island Falls plant of the Churchill Power Company.

Ontario

No new developments were completed by the Hydro-Electric Power Commission of Ontario, though four major projects were under active construction, three being located in southern Ontario and one north of Lake Superior; a fifth project consisting of the extension of a northern Ontario development was also commenced.

Reference was made in last year's review to a second 70,000-hp. unit at DeCew Falls. Extensive improvements are under way in the headwater area which will increase the pondage available and raise the headwater elevation by about 4 ft. The tailwater also is being lowered. The new unit is expected to be in service by October, 1947. Work proceeded on the 81,000-hp. development at Stewartville on the Madawaska River. The first unit of the plant is expected to be in operation by February 1, 1948. Preliminary work has also commenced on the Des Joachims development on the Ottawa River upstream from Pembroke. The development will have a capacity of 360,000 hp. in six units of about 60,000 hp., with provision for two additional units. The plant will have

(Continued on page 33)

From Month to Month

News of the Institute and other Societies, Comments and Correspondence, Elections and Transfers

THE DIAMOND JUBILEE

In February 1947, The Engineering Institute of Canada will have completed sixty years of service to Canada and to the profession. This occasion is to be marked by special features at the annual meeting in Toronto on May 8th, 9th and 10th.

The Institute, then known as the Canadian Society of Civil Engineers, was organized on February 24th, 1887, and was incorporated by federal charter on the 23rd of June the same year. On the walls at Headquarters there is the first certificate of membership ever issued. It is in the name of T. C. Keefer, the first president, and is signed by Mr. Keefer in that capacity and by Henry T. Bovey as secretary. Strangely enough, it is dated January 20th, 1887, which might indicate that they worked a lot faster in those days than we do now. More probably what has occurred is that the organization was functioning well in advance of receiving its charter. The early history shows that the society had completed the organizational work in 1886, and it is easy to believe that they went to work immediately.

Those who have followed these pioneers of the profession, have learned with gratitude of their wisdom in setting up a society that would cater to all classifications of engineers. As the charter says one of the objectives of the society was " to encourage investigation in connection with all branches and departments of knowledge connected with the profession ".

This policy has enabled Canadian engineers to work together as one group rather than scatter their efforts through a multitude of smaller societies, each dealing with one specialization, or to lose their identity in the excellent but gigantic specialized societies of the United States and Great Britain.

The Canadian type of organization has been adopted in Australia, New Zealand, India and South Africa. In each of the countries there is an engineering institute, embracing all branches of the profession. Canada's example has been followed in other countries as well, such as Switzerland, Belgium and Holland. In the more populous countries where the specialized society has made most progress there is an increasing demand for some sort of set-up that will provide for the co-operative effort of all engineers. Canada has that type of organization now in the Institute, and to its far sighted founders belongs the credit.

Each month in the *Journal* there will be news about the Diamond Jubilee, but members are urged to accept this notice now and to make all arrangements at the earliest date. Hotel and transportation accommodation will still be hard to get then, but early attention to these details will help avoid confusion and disappointment.

The dates are May 8th, 9th and 10th and the hotel is the Royal York at Toronto. There will be a regional meeting of Council on the 7th.

THE NEW BY-LAWS BEGIN TO WORK

Last spring, members voted favourably on several important amendments to the by-laws. With the turning of the year these all become effective—and the results will soon be apparent to every member. Firstly, the fees have been increased, for Members and Juniors, as the annual account will show. Secondly, a routine transfer from Student to Junior was agreed upon, and thirdly, all members became eligible for Life Membership. Treating with these in reverse order the results so far are as follows.

Life Members

Any person who has paid fees as a corporate member for thirty-five years, or who has reached age seventy and has paid fees as a corporate member for thirty years, is entitled to Life Membership. On January 1st, 209 Members became Life Members and will not be required to pay the annual fee in the future. One of these, John Murphy of Ottawa, has been a corporate member for fifty-seven years and has paid fees in full for that period of time. There are members in the Institute whose membership goes back farther than that but of the first group to be affected by the new by-laws Mr. Murphy is surely the *doyen*. Support of this kind is one of the things that has made the success of the Institute possible.

Transfers

A Student member who has been graduated is now transferred automatically (without transfer fee) on the second January after his graduation. Under this by-law, 988 Students have just become Juniors. Non-graduates are still required to write an examination.

A new privilege is also available to Juniors. They may now transfer to Member without paying a transfer fee, providing they apply before the end of the seventh year after graduation and their qualifications meet the approval of Council. They may not remain as Juniors beyond the end of the eighth year after graduation.

These far reaching changes will mean great things for the Institute. They wipe out the old difficulties about Life Membership which used to be optional with Council. Now everyone is entitled to it, and each January new groups will reach this exalted rank. All this means a serious loss of revenue but it will be more than made up by the increase in fees, and the quicker transfer of Students to Juniors. On the whole, the change in the transfer system should produce an increase in income greater than the loss entailed in the new rules for Life Membership. Incidentally, the changes bring about great savings in labour at Headquarters.

As the working of these by-laws comes to the attention of the membership, they are urged to communicate with Headquarters if any points are not clear. There has been a lot of overtime work and pressure to get the machinery in motion and the material ready for " processing ". Nobody will be surprised if in some instances changes or adjustments become necessary.

THIS JOURNAL IS DIFFERENT

Cutting its coat according to its cloth, the *Journal* must again squeeze its expanding features of mature publication into the tight-fitting garb adopted during the war as an economy measure. Starting with this issue, the format is now 8¼ by 11¼ in., which is ¼ in. all around smaller than the previous size.

It will be recalled that, in March 1946, the *Journal* along with other publications in the same field, returned to pre-war size. Such a move was evidently premature as the paper supply situation, far from improving, has deteriorated to a point where the shortage is more acute than at any time during the war. The National Industrial Advertisers Association having decided to return to the economy trim size, the *Journal* must follow suit because the same printing plates are being used for the same advertisements in several publications. From the reader's point of view, the change is hardly perceptible, and is no hardship to anyone but the editor who has had to make several readjustments.

New Features

Upon the recommendation of the Publication Committee, a new cover design has been adopted which, it is believed, improves the outside appearance, at the same time retaining the characteristic features which have identified the monthly publication of the Institute since its beginnings. One of the advantages of the new design is that it allows a better display on the cover.

Another improvement, which should meet with the reader's approval, is the introduction of a short summary at the beginning of each technical article, which enables a reader to decide at a quick glance whether or not the article is of interest to him.

As the paper supply improves, and the additional editorial staff made possible by the increase in fees has been secured, other improvements will be introduced which should make the *Journal* more valuable. Among these are the revival of the former section containing abstracts of current technical literature and the establishment of a special section for students.

LORNE CAMPBELL AWARDED KENNEDY MEDAL

The Sir John Kennedy Medal, the Institute's senior award, goes this year to Lorne A. Campbell, M.E.I.C., president and managing director of the West Kootenay Power and Light Company, Trail, B.C. This was announced at a recent meeting of Council when the letter-ballots from councillors were opened.

The medal is awarded by the council of the Institute at intervals of not less than two years as " a recognition of outstanding merit in the profession or of noteworthy contributions to the science of engineering or to the benefit of the Institute ". It was established in 1927, in commemoration of the great services rendered to the development of Canada, to engineering science and to the profession by the late Sir John Kennedy, past-president of the Institute.

Mr. Campbell was born at Perth, Ont., on March 5th, 1871. Educated in the public schools and Collegiate Institute of Perth, he joined the engineering staff of the Edison General Electric Company in Toronto in 1889, becoming chief engineer of its successor, the Canadian General Electric Co., in 1891, at the age of 22.

Moving West in 1898, to Rossland, B.C., he became general manager of the newly formed West Kootenay Power and Light Co. Limited, organized by Sir Charles Ross to develop power on the Kootenay river for the mines in that area. Later he became vice-president of the company. In 1912, he was elected to the B.C. legislature for the Rossland-Trail constituency, and in 1916, he was appointed to the cabinet of the conservative provincial government as Minister of Mines.

Now president and managing director of the West Kootenay Power and Light Company, he is also president of the McGillivray Creek Coal and Coke Company and a director of the Consolidated Mining and Smelting Co. Ltd. He is also member of the Trail Board of Trade and Rotary, and in 1942 was vice-president of the Associated Boards of Trade of B.C.

He married Mary Spahr Hosier, of Jamestown, Ohio, in 1903, and has one son and one daughter. He continues to make his home in Rossland, where he has lived for 48 years and takes an active interest in local community welfare, particularly in regard to hospitals.

CONGRATULATIONS TO TORONTO

The year 1946 marked the Diamond Jubilee of the University of Toronto Engineering Society. The sixtieth edition of the Transactions and Year Book has just come to hand to remind us of this important event and to refresh our minds on many historic details. The Society reaches its jubilee one year before the Institute, and therefore takes seniority over it. In due appreciation of this relationship the Institute sends its warmest greetings to its elder brother, and expresses the hope that the future may give it equal opportunities for service as has the past, and that the strength to meet them accompanies the opportunities.

At the banquet which featured the celebration, Dr. T. Kennard Thomson, M.E.I.C., a gradute of '86, was the special guest. It was his interest and unextinguishable enthusiasm that brought the Society into existence so many years ago. It was fitting that he should have been selected as the guest of honour. Those who had the rare privilege of knowing Dean John Galbraith would applaud Dr. Thomson's words " John Galbraith—was a Man and an Engineer who has never been excelled ", but it was not known to all that he had so large a part in the formation of the Society. Dr. Thomson says " If there had been no John Galbraith there would have been no S.P.S. and no U. of T. Engineering Society ".

Dr. Galbraith was the first president of the society, and Professor H. E. T. Haultain, M.E.I.C., was the first student to be president. Other pioneers who were closely associated with the beginning of the Society were Dr. James L. Morris, M.E.I.C., Dr. George Herrick Duggan, Hon. M.E.I.C., and W. F Tye, M.E.I.C. These names are also part of the early history of the Institute and indicate the similarity of interests of the two organizations. Both were the result of the same interests and the same desires.

From this happy relationship of a common beginning, a common objective and a parallel history, the Institute looks forward with the Society to the future development of Canada and the profession in which both will have so important a part to play.

JULIAN C. SMITH MEDALS

Go to Chas. Camsell and J. B. Challies

Two past-presidents of the Institute, who have been closely associated with the development of Canada's natural resources, are the recipients of Julian C. Smith Medals for 1946.

Established in 1939 to perpetuate the name of the late past-president of the Institute, the medal is awarded by Council upon the recommendation of a special committee consisting of the president and two members of council appointed by him.

After forty years in the public service of Canada, Dr. Charles Camsell retired last spring from the position of Deputy Minister of Mines and Resources. Graduating with a B.A. from the University of Manitoba in 1894, he later took post-graduate courses in geology at Queen's University in 1901, at Harvard University in 1903, and carried on further advanced studies at Massachusetts Institute of Technology in 1908 and 1909.

From 1894 until his appointment as Deputy Minister of Mines in 1920, Dr. Camsell was engaged in the study and exploration needed to ascertain geological data of the kind on which mining and engineering work must be based. Later, his duties at Ottawa have given him a thorough acquaintance with the Canadian mining industry and with Canadian problems connected with fuel and power supply.

In 1920 he was appointed Deputy Minister of the Federal Department of Mines, (now the Department of Mines and Resources) and since that time he has served as chairman of the Dominion Fuel Board, as member of Council for the Northwest Territories, as a member of the National Research Council, as a member of the special International Niagara Board, and as Chairman of the Canadian National Committee of the World Power Conference.

Dr. Camsell joined the Institute as a Member on February 16th, 1923, served on Council in 1929 and 1930, and was president in 1932. He was vice-president of the Canadian Institute of Mining and Metallurgy in 1921-22, and was elected president for the current year, vice-president of the Royal Society of Canada in 1930, becoming its president in 1931, was president and one of the founders of the Canadian Geographical Society, and holds membership in a number of other scientific and learned organizations.

Among his academic honours may be noted the degree of LL.D., which he received from Queen's University in 1922 and from the University of Alberta in 1929. His achievements as an explorer were recognized in 1922 by the award to him of the Murchison Grant by the Royal Geographical Society as an appreciation of his services in exploring northern Canada; his long connection with the mining industry was fittingly acknowledged in 1931 when the Institution of Mining and Metallurgy, London, presented him with its gold medal for his work in promoting the development of the natural resources of the Dominion and furthering the general interests of the mineral industry.

In 1935, in the King's Birthday List of Honours, Dr. Camsell was made a Companion of the Order of St. Michael and St. George.

In 1945 Dr. Camsell was awarded the R. B. Bennett Empire Prize of 100 guineas for his paper "Canada's New North" which was read before the Royal Society of Arts; also the Founders' Medal of the Royal Geographical Society in recognition of his contribution to the geology and geography of the Canadian north and for his work in advancing geographical science in the Dominion. In April 1946, he was honoured by the Professional Institute of the Civil Service of Canada with a special award of its medal in recognition of his outstanding contribution to science and administration during his forty years in the public service.

A vice-president and executive engineer with the Shawinigan Water and Power Company, Dr. J. B. Challies is a recognized authority on administrative investigatory and international features of water resources and power matters.

A graduate of the University of Toronto in the class of 1903, Dr. Challies commenced his professional career at Ottawa as an engineer of the Topographical Surveys of Canada. Subsequently he successively occupied the positions of chief hydraulic engineer, Department of the Interior; superintendent of Water Power for Canada; director and chief engineer of Water Power and Reclamation Service; director, Dominion Hydrometric Survey; member, Dominion Power Board; member, Dominion Fuel Board; consulting engineer to the Department of External Affairs. In the latter position, as adviser to four Federal premiers, he was for many years a familiar figure before the International Joint Commission and at Federal-Provincial conferences regarding international waterway matters. As its first director, he was largely responsible for the organization of the Hydrometric Survey of Canada and the Water Power Bureau which are of great importance to engineers dealing with run-off or river flow problems. He took a leading part as special liaison officer representing the Federal Departments in the establishing of the National Research Council. Few contributed more constructively to the Dominion-wide movement among governmental employees for an adequate recognition of the engineer in the public service. He was one of the founders of the Professional Institute of the Civil Service. He represented the Government of Canada at the International Engineering Congress in San Francisco in 1915. The outstandingly successful character of Canadian participation in the World Power Conference at London in 1924, at Berlin in 1930, and at Washington in 1936, was due in no small measure to Dr. Challies' initiative. While in the Federal Public Service he was a recognized authority on administrative, investigatory and international features of water resources and power matters. Since assuming, in 1924, a professional position with The Shawinigan Water and Power Company, of which Company he is now a vice-president, he has become equally well known in the electrical utility field.

In 1938, the University of Toronto conferred upon Mr. Challies the honorary degree of Doctor of Engineering, for achievement in the conservation and use of the water power resources of Canada."

Dr. Challies' activities in the Institute were crowned by his election to the presidency in 1938.

In 1945-46 he served as chairman of the executive committee of the Canadian Chamber of Commerce.

A prominent layman in the United Church of Canada, he is chairman of the board of governors of the United Theological College, Montreal.

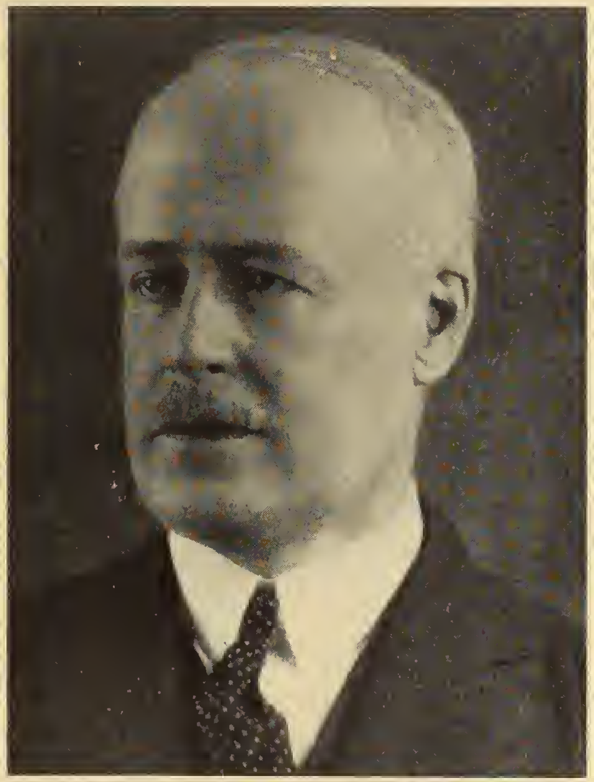
GEORGE ALEXANDER WALKEM

1872-1946

One of Western Canada's most distinguished engineers and industrialists, and a past-president of the Institute, died in Vancouver on Friday, December 13th, 1946. George A. Walkem, has lived in the west for almost fifty years. He established a number of leading industries at the coast, all of which were active in the production of war materials.

Born on July 8th, 1872, at Kingston, Ont., Mr. Walkem attended Kingston public and high schools, and received his engineering education at McGill University, where he obtained the degree of B.Sc. in 1896. He had previously served an apprenticeship in the Kingston Foundry and Locomotive Works from 1887 to 1891. For two years after graduation, he was employed as engineer with the Collins Bay Rafting Company and in 1898 he went to British Columbia where he worked on construction for the British Columbia Electric Railway at Vancouver until 1899 when he established a consulting mechanical engineering practice which he carried on until 1901. In that year, he was appointed manager of the Vancouver Engineering Works Ltd., then the largest plant in the province. In 1906, Mr. Walkem incorporated the Vancouver Machinery Depot Ltd., and, in 1911, the Gulf of Georgia Towing Company, of which he was president until last year.

In 1915, he went to England and secured a commission in the Royal Engineers, serving in France, Egypt and Palestine. His duties in Egypt and Palestine included the charge of the Kantara Military Railway, and work in connection with its extension across the Sinai Desert to Beersheba, with other branches to Jerusalem and Haifa. This involved a great deal of construction as well as maintenance work, and Major Walkem was mentioned in despatches by Lord Allenby "for gallant and distinguished service in the field".



George Alexander Walkem.

After the war, Mr. Walkem re-established himself in Vancouver, eventually becoming president and general manager of the Gulf of Georgia Towing Company, one of the most important maritime activities on the west coast. Associated with the latter is the West Coast Salvage and Contracting Company Ltd., of which Mr. Walkem was president and managing director.

In the year 1926, a new company was formed, the Vancouver Iron Works Ltd., which, under Mr. Walkem's presidency, expanded its business enormously and played an important part in the manufacture of ship machinery during the last war.

As a further aid to the war effort, a new company was formed in 1942 and established a four-berth shipyard to build freighters. The West Coast Shipbuilders Ltd., of which Mr. Walkem was president, built 52 ships of the 10,000-ton class.

The war work of the companies with which Mr. Walkem was associated has been distinguished for the ingenuity applied throughout their operations. Under Mr. Walkem's leadership, entirely new methods and operations were developed that greatly reduced costs and increased production. This was particularly true in the boiler plant where his methods were outstanding in their originality and their success, and became a pattern for other manufacturers.

Mr. Walkem's interest in the professional and industrial fields was equalled by his public service. On his return to Vancouver after the first world war, he became interested in municipal and provincial political activities, sitting as a member in the Provincial House of Assembly for five years. In 1920 he was able to assist in securing the legislation which established the Association of Professional Engineers of British Columbia, one of the two organizations of which he was president in 1926. The other was the Engineering Institute of Canada.

For fifteen years, Mr. Walkem was on the board of the Vancouver General Hospital, two years as chairman. He also took an active interest in the Children's Aid Society of Vancouver, the Queen Alexandria Solarium for Crippled Children, and the Sea Scouts. For a number of years, he lectured on a voluntary basis on industrial management in the department of mechanical engineering at the University of British Columbia. It is interesting to recall, at this point, that Mr. Walkem's father had been a well-known lecturer at Queen's University, Kingston.

Joining the Institute in 1906 as an Associate Member, he was elected Member in 1920. He served as a councillor during 1921 and 1922 and was vice-president during 1923 and 1924. He was elected to the presidency in 1926. Last year, Mr. Walkem was awarded the Julian C. Smith Medal of the Institute "for achievement in the development of Canada". He was a member of the Institution of Mechanical

Engineers (Great Britain) and of the American Society of Civil Engineers.

Surviving are his widow, formerly Mrs. J. Byrn (Mary Collins), and four children, Lt.-Col. Richard Walkem, A. D. Walkem, Mrs. John Baxter, and Mrs. Harry Alder, all of Vancouver. The youngest son, George, was killed in action while in service with the R.C.A.F. There are also three step-children, Stafford Byrn, Mrs. R. Bicknell, both of Vancouver, and Lt.-Col. J. C. Byrn, O.B.E., M.E.I.C., of Montreal. Mr. Walkem leaves also one sister and two brothers, Mrs. Henry Joseph, Lt-Col. Hugh Walkem, both of Montreal, and Knox Walkem, K.C., of Vancouver.

EIGHTH INTERNATIONAL MANAGEMENT CONGRESS

Stockholm, July 3-8, 1947

After a lapse of nine years between meetings, the International Committee of Scientific Management (Comité International de l'Organisation Scientifique, C.I.O.S.) will meet in Stockholm, Sweden, next summer.

World Management Congresses have previously been held in Prague (1924), Brussels (1925), Rome (1927), Paris (1929), Amsterdam (1932), London (1935) and Washington (1938).

It is appropriate that leaders of thought and action should meet to review and evaluate the extensive developments in management work since 1938 and to examine management problems of tomorrow. This is the background to the Eighth International Management Congress.

The programme and discussions of the Congress will in the main serve:

> "to state and appraise the progress made in the various fields of management (industry, agriculture, public administration and the home),
>
> to provide a meeting ground for the exchange of ideas and experiences between people in responsible positions of management in different countries,
>
> to discuss the function of economic planning on different levels,
>
> to examine ways and means of promoting improved education for management and raising the level of economic thinking."

The programme comprises Plenary Sessions, Sectional Meetings and Study Tours.

Canadian Participation

Participation of the various countries is arranged by national committees made up of representatives of the various organizations interested in the objects of C.I.O.S. In view of the leading part played by engineers in management, W. L. Batt, Hon.M.E.I.C., president of C.I.O.S. and president of S.K.F. Industries, Philadelphia, has requested The Engineering Institute of Canada to bring the various Canadian organizations together with the object of having them set up a co-operative group that could apply for membership in C.I.O.S. Meetings have been held and the matter is now under way.

Last June the executive committee of the Congress met in Stockholm and the Institute was represented by Frederick Palmer, M.E.I.C., who is Canadian Government Trade Commissioner in that city. Mr. Palmer reports that representatives were in attendance from Great Britain, France, Belgium, Sweden, Denmark and the United States, with the chairman, W. L. Batt, presiding. Several procedures for the future of the organization were agreed upon.

The American delegation has chartered a ship for the journey to Stockholm and has set aside accommodation for twenty Canadians. A conference has been arranged for the voyage which will provide unusual opportunities for study and discussion, with several leading American management experts taking the lead.

Anyone interested in attending the Congress may get further details from Headquarters.

RELIEF FROM TAXATION

While the amount is not large a recent reduction in tax expenditure will be well received. Engineers will be glad to know that certain fees which they pay are now deductible from their incomes for tax computation purposes.

Over several years the Institute has been protesting to the Department of National Revenue that fees paid by engineers to their professional societies should be free of income tax, but answer to letters and to delegations was firm—that persons who worked for a salary were not entitled to any deductions for expenses.

It has taken the lawyers to succeed where engineers have failed. A lawyer of Winnipeg, by name Bond, took action against the Minister of National Revenue in the Exchequer Court of Canada, and won his case. Although the case applied to a lawyer it seems evident that it should apply equally well to engineers.

To clarify this point the general secretary wrote the Minister and received a reply which is reproduced at the conclusion of this article. That letter indicates that the fees of engineers to their provincial professional associations (or corporation) are now deductible for tax purposes. According to the Department's ruling as shown in the letter, the same deduction is not permissible for the fees of the Institute.

The limitations placed on the salaried engineer have never applied to the self-employed or consulting engineer. He has deducted his fees to professional societies for many years. It is a simple matter for him to show that membership in organizations even beyond the registration body, is necessary to his business.

It is interesting to read the Reasons for Judgment given by Mr. Justice Thorson. In it he appears to reprimand the Minister for his dogmatic decision. The Minister's reply to the appellant's original appeal reads:

"The Honourable the Minister of National Revenue having duly considered the facts as set forth in the Notice of Appeal and matters thereto relating hereby affirms the said Assessment on the ground that the taxpayer has been correctly assessed and that the deductions claimed are not permissible under the provisions of the Act. Therefore on these and related grounds and by reason of other provisions of the Income War Tax Act the said Assessment is affirmed."

To this Mr. Thorson says in a reproving phraseology:

"The ground thus assigned for affirming the assessment does not disclose any specific reasons at all. But the validity or otherwise of an assessment does not depend upon the soundness or unsoundness of the reasons given by the Minister for his decision on the appeal to him under section 58 of the Act or whether reasons are given or not. The appeal to the Court provided by the Act is an appeal from the assessment, not from the Minister's decision or the reasons or lack of reasons for it".

Herewith is the letter from the Department:

"L. Austin Wright, Esq., M.E.I.C.,
General Secretary, etc.

Dear Sir:

With reference to your letter of November 19th, we are enclosing for your information a copy of the Reasons for Judgment of Mr. Justice Thorson in the case of Bond v. Minister of National Revenue. From that you will see that the professional man on a salary is permitted to deduct his annual fees if payment of such is absolutely necessary in order to carry out his duties. However, if Mr. Bond had not been required to appear in the Manitoba Courts, it would not have been necessary for him to be a member of the Manitoba Bar.

As you will see, under the law of Manitoba, Mr. Bond was required to be a member of the Bar Society if he practised in the Courts of that Province. Is there any similar legislation requiring your members to belong to your Society or to any provincial organization?

Comparing the case again with the lawyers, membership in the Canadian Bar Association would not be an allowable deduction as no one is under any obligation to belong to that society and may practise his profession without being a member.

Yours faithfully

(Signed) C. F. Elliott,
Deputy Minister (Taxation)

NEWCOMEN SOCIETY IN AMERICA

Canadians will be pleased at the recent announcement that D. C. Coleman, chairman and president of the Canadian Pacific Railway Company, has been honoured with the presidency of the Newcomen Society of England. He is the first Canadian to hold this high office and is the third person in North America to be so honoured. For some time, Mr. Coleman has been active in the American activities, and to those who are familiar with the affairs of the Society his appointment to the presidency seems a logical development.

The Newcomen Society of England has as its principal aim the fostering of research and study of the history of material civilization throughout the world. As would be expected, such an objective comes very close to the work and to the hearts of engineers. As a consequence, the membership of the Society is built up largely of engineers, physicists and industrialists. Another great purpose of the Society is to promote friendly and intimate relations between Great Britain, the United States and Canada.

The members of the Institute will be interested to know that of the three presidents who have come from this side of the water one was Col. C. E. Davies, secretary of the American Society of Mechanical Engineers, and a member of The Engineering Institute of Canada. The third president was W. M. Vermilye, senior vice-president of the National City Bank of New York.

It will be very gratifying to Canadians to know that the proposal of Mr. Coleman's nomination for the presidency was put forward at the annual elections in London, England, by the American Headquarters of the Society in New York.

CIVIL SERVICE IMPROVEMENTS IN U.S.

Recently, the Board of the United States Civil Service Examiners for the Scientific and Technical Personnel of the Potomac River Naval Command has been formed as the authority for evaluating new employees to be delegated to the laboratories. This has come as the result of joint efforts of the Naval Research Laboratory, the Naval Ordnance Laboratory and the David Taylor Model Basin.

The creation of this Board is of particular significance to Canadian engineers. It is along the lines of the Technical Panel which the Institute recommended in its report to the recently held Royal Commission, and appears to be the only commonsense solution of the many personnel problems now in the hands of government departments and agencies. There has been so much bad management as far as professional workers are concerned, due to the policy of handling these things with non-professional workers, that something has to be done or the government activities will not be carried on efficiently or economically.

The United States Board will be made up of scientists whose time will be devoted exclusively to the procurement and evaluation of scientific and technical personnel. In this way, the Navy has shown its high regard for its scientific personnel, and has recognized the scientific service as an integral unit in its organization. So far as is known, this is the first Board of Examiners which is composed of scientists devoted exclusively to the scientific service. In Great Britain, a year ago, a somewhat similar set-up was adopted, but in their case the board was referred to as a scientific and technical panel and was made up of professional employees from various departments.

It would be a splendid achievement if something of this kind would be adopted at Ottawa. There seems to be no other way to solve satisfactorily the special problems of the many services.

MAYOR CONSULTS THE INSTITUTE

Mayor Bridges of Moncton, N.B., seems to be a man of good common sense. When a serious problem of an engineering nature faced the city he asked the branch of the Institute to call a special meeting of the executive so that he could discuss it with them.

According to the *Moncton Transcript*, the city is facing a serious water shortage due to the unusually low water precipitation. The average precipitation for the last twenty years is 38.10 in. whereas this year's figure is only 25.99 in., the lowest on record. The water level at the reservoir is 16 ft. 8 in. lower than normal for this time of year and the supply is being used up at a rate of more than two million gallons a day, which is two million below normal.

The meeting with the executive resulted in a decision to sink some wells to find new sources of supply. The provincial geologist was sent for in order to check with him on locations that were agreed upon. It is expected that artesian wells not far from the reservoir will solve the problem without the necessity of laying extensive pipe lines, as the outflow could be directed into the normal stream channels.

The action of Mayor Bridges is a tribute to the Moncton engineers — a recognition of their special training and experience in the terms of the special needs of the municipality.

A MEMORIAL TO ROYAL CANADIAN ENGINEERS

Military Engineers Association of Canada
Ottawa, Dec. 20, 1946.

The Secretary,
Engineering Institute of Canada.

Dear Dr. Wright:

General Turner told me about your interest in the memorial to the Royal Canadian Engineers and I believe he mentioned to you our plans to raise $3,500 so that we can start the preparation of our second "Book of Remembrance". The following is a fairly complete story of our previous efforts and a description of the book, a copy of which I am sending for your members to see.

In memory of a great soldier and engineer, Earl Kitchener, All Souls Chapel of St. Paul's Cathedral was erected. By kind permission of the Dean and Chapter it was arranged that the rolls of honour of all ranks of the Corps throughout the British Commonwealth who fell in World War I should be deposited in the chapel as part of the Royal Engineers War Memorial. Subsequently, rolls commemorating the Engineers of Australia, New Zealand and India were deposited in this chapel.

At the Annual Meeting of the Military Engineers Association of Canada in 1935 a committee was appointed to consider and report on the Canadian Engineers part in this memorial. After careful study it was decided that a "Book of Remembrance" should be prepared containing the 2004 names of Engineers, Signals and Pioneers who had died prior to demobilization. Signals were included because, during World War I, they were part of the Corps of Engineers and did not become a separate Corps until later.

We were fortunate in securing the services of Miss Grace Melvin, D.A., head of the Department of Design of the Vancouver School of Arts to do the intricate illumination and lettering and the work was finally completed in 1944. After being viewed by His Excellency the Governor General, the Prime Minister and Gen. McNaughton, the book was placed in the National Art Gallery pending an opportunity of delivering to the custody of the Dean and Chapter of St. Paul's Cathedral. This occasion took place on the 6th of July, 1945, at an appropriate ceremony attended by representatives of the Corps of Royal Engineers and Royal Canadian Engineers.

The opening page of illumination, in full colour, suggests the spirit and message of the book. The text is an excerpt from a poem by the Canadian poet, Duncan Campbell Scott, "Why Mourn Thy Dead", and is dedicated to the "bereaved" of the Canadian Engineers whose names are written on the following pages. At the top left hand corner of the page, an angel, militant, supports the laurel leaf of the immortals, who form a symbolic procession in the broad border at the foot of the page.

The words of the poem read:

"Why mourn thy dead, they are the world's possessions?
These our immortals—Shall we give them up
To the complaint of private loss and dole?
Nay—mourn for them, if mourn thou must,—
Grief is thy private treasure;
Thy soul alone can count its weight or measure,
But we who know they saved the world
Think of them joined to that unwithering throng,
Who in the long dread strife
Have thought and fought for Liberty.

Be comforted,—nay sob, if sob thou must,
Cover thy face and dim thy head with dust,
And we who know they live
Gather thy dead in triumph—
Exalted from the caves of memory,
Purified from the least as soil of time—
And lay them with all that is most living,
In light transcendent,
In the ageless aisles of silence,
With the Immortals that have saved the world."

Page two is dedicated to "the Dead" and the dominant theme is the golden cross of sacrifice surmounted with the martyrs' crown of victory. Supporting the cross are two kneeling angels each holding the "Torch of Remembrance". The cross is rooted in a symbolic rendering of the maple trees of Canada, in whose branches the Canadian song-birds sing their immortal songs. On the heraldic riband on the cross are the words: "Vincet amor patriæ" (Love of country will conquer). At the foot of the page is the quotation from Virgil's Aeneid":

"Et quorum pars magna fui";

and the translation of the full passage is:

"All the deeds of woe mine eyes beheld
and those whereof I was no small part".

Above this quotation are the words from the Apocalypse:

"Be thou faithful unto death and I will give thee a crown of life".

The entire page is in gold leaf—vermilion and white.

Page three is the "title page" showing the badge of the Canadian Engineers, below which is lettered the following quotation from Lawrence Binyon.

"They shall grow not old;
As we that are left grow old;
Age shall not weary them,
Nor the years condemn.
At the going down of the sun and in the morning
We will remember them."

Heraldic borders complete this page.

The next twenty-four pages are devoted to the 2004 names of the fallen together with rank and date of death. Throughout these pages, incidental decoration and borders are used, introducing knots, shoulder badges of C.E. units—bridges, men with shovels, crossed flags, grenades and other Engineer motifs. The names are arranged in three groups: 1. Engineers, 2. Signals, 3. Pioneers.

On the last page there is a "Prayer For Canada" taken from a poem written by Duncan Campbell Scott in 1911. The words are prophetically suitable for the ending of this book:

"Grant us this presage for a guiding star,
To lead the van of peace, not with a craven spirit,
But with the consciousness that we inherit
What built the Empire out of blood and fire,
And can smite, too, in passion and with ire,
Purge us of pride, who are so quick in vaunting
Thy gist, this land, that is in nothing wanting;
Give mind to match the glory of the gift,
Give great Ideals to bridge the sordid rift
Between our heritage and our use of it.
Then in some day of terror for the world:

When all the flags of the Furies are unfurled,
When Truth and Justice, wildered and unknit,
Shall turn for help to this young, radiant land,
What shall we answer in that stricken hour?
Shall the deep thought be pregnant then with power?
Shall the few words spring swift and grave and clear?
Use well the present moment. They shall hear ".

The binding is in rich red English Morocco, lined with blue English Morocco. The large cross in the centre and the border are modelled in relief.

The entire book is carried out with original " Work of Art " of the 20th century, and is not in any way copied from traditional illumination.

Once again we are preparing a record, which may be placed with those of the other members of the Commonwealth, of the personnel of the Corps who failed to return. For this purpose a committee has been formed under the chairmanship of Maj. Gen. G. R. Turner, C.B., M.C., D.C.M., with Lt. Col. J. A. Warburton, P.O. Box 591, Ottawa as treasurer. Contributions will be gratefully received from former Sappers and members of the families of those who thought enough of Canada to give their lives

Any assistance you can give in publicizing our appeal will be greatly appreciated. As you will appreciate our only direct contact is through our Branches and the Army. We have no means of reaching former Sappers who, when they returned to professional practice, severed all connections with things military.

Yours sincerely,

E. M. Medlen, M.E.I.C.,
Hon. Secy.

❖ ❖ ❖

Editor's Note

The *Journal* is happy to bring Mr. Medlen's letter to the attention of its readers as in this way they will be made aware of the proposal to prepare a worthy record of the personnel of the Corps who gave their lives in the recent war.

During his recent visit to England, the general secretary visited the chapel referred to in Mr. Medlen's letter (All Souls of St. Paul's). It is indeed a beautiful memorial. As is pointed out, the main purpose of the chapel is to commemorate the deeds of Earl Kitchener. Occupying the main portion of the floor area is a magnificent life size white marble figure of the great soldier (reclining), and in the north wall beyond the figure, facing the single entrance, is a recess closed with a bronze grill behind which is the " Book of Remembrance ".

Engineers who visit St. Paul's will find this chapel worthy of special attention. It is easy to find, being the first opening to the left of the main entrance of the cathedral.

Incidentally, the photostatic copy of the Book of Remembrance will be at Headquarters for some time, where it can be seen by anyone who is interested.

POET TO ENGINEER

Alexander Pope in his " Epistle to Lord Bathurst " in Moral Essays (1731-5) sums up in a few lines the contribution of the engineer of that time to the development of prosperity in his homeland. Where is the poet who can so succinctly describe the task of today's engineer in the rebuilding of the world; who can so colourfully praise the work of the successors to those early masters of the profession? Pray God that again

" These honours Peace to happy Britain brings ".

"Bid harbours open, public ways extend,
Bid temples, worthier of the God, ascend;
Bid the broad arch the dangerous flood contain,
The mole projected break the roaring main,
Back to his bounds their subject sea command,
And roll obedient rivers thru' the land.
These honours Peace to happy Britain brings;
These are imperial works, and worthy Kings."

AN APPEAL FROM GREECE

We are glad to print the following letter, which was recently received at Headquarters. The letter was written in French, and the following is a literal translation:

Florina, Oct. 28th, 1946.

To our confreres,

The Civil Engineers of Great Britain, United States of America, Canada, Australia, Brazil, South Africa.

Gentlemen:

From Florina, the remotest Greek city between Yugoslavia and Albania, wherefrom, for the first time, the Greek forces pushed the enemy back and gave the United Nations in the war against the Axis (up to then invincible) their first victory (capture of the city of Corytsa) we, the chief engineer of the Department of Public Works of Florina, and the engineer in charge of works for the township, send to you all, our confreres at work, our warmest salutations.

In this distant part of our beloved and heroic country, alone we supervise the reconstruction of our communications destroyed without mercy by the enemy.

In this superhuman task, alone without any mechanical help because we are short of everything, we still find an insurmountable obstacle and enormous difficulty as a result of the absolute lack of office instruments.

Unfortunately, our country in its gigantic effort of reconstruction with the meagre means at its disposal, cannot supply the necessary instruments.

For this reason we appeal to you and request your assistance in the difficulties facing us, and we ask you to send to us all the office instruments that you can dispose of, that is, tachometers, levels, slide rules, draughting instruments, etc.

Such shipments from you would brace up our courage in our work, in the same way as the sole thought during the war that we were fighting against the same enemies and for the same cause gave our people and our forces the courage and the tenacity to face the Axis victoriously in the towns and on the battlefield.

Looking forward to a favourable response to our request, we would like to express our most sincere thanks.

(Signed) Spyros Dimitriades,
Civil Engineer i/c Public Works for the Department of Florina, Greece.

(Signed) Georges Carayamis,
Civil Engineer, A.I.G., Florina, Greece.

CORRESPONDENCE

Montreal Public Lacks Adequate Protection

The following letter was sent to the editors of the Montreal dailies by the general secretary of the Institute.

November 22nd, 1946.

Dear Sir:

The recent failure of a newly poured concrete wall in Montreal has focussed attention on a condition which, in our opinion, requires correction. The wall failed—not because of faulty engineering design, but because of failure to build it in accordance with good construction practice. It appears that a competent and qualified engineer was engaged to do the designing but that the services of a qualified engineer were not retained to supervise construction. The one without the other is senseless and in the public interest should not be permitted.

A quick examination of the regulations does not reveal that the building inspection department of the City of Montreal has any authority to demand that competent engineering services be retained until the construction work is completed. A committee appointed by the Engineering Institute has investigated this particular case and, from their report, it appears that the collapse of the wall was due to failure to shore up the adjacent earth embankment and to properly brace the concrete walls after pouring, pending construction of adjacent floors.

Again in this instance deep excavation was made below the level of the bottom of the wall and adjacent to it. Naturally the subsequent settlement of the earth embankment was accompanied by a movement in the wall, and eventually the overloaded embankment gave way, carrying with it a large part of the concrete wall and imprisoning beneath it a workman whose life was in danger for many hours before he could be released.

The lesson to be learned is that all owners of buildings under construction should be forced to maintain competent professional services until the work is completed. Good construction methods and design are two inseparable requisites for safe and satisfactory building. Without either the lives of the people are not protected adequately. Something should be done to put the proper authority into the hands of the city.

It is unfortunate that from newspaper accounts of this minor disaster some persons should have gained the impression that it was due to faulty engineering. Such was not the case. It was due to the failure to have a professional engineer on the job during construction—a condition which it is difficult to realize would be permitted in a city the size of Montreal.

It would be appreciated if you would publish this letter so that to some extent at least the public will understand what has occurred. Perhaps too, a wider realization of the shortcomings of the present building regulations will be helpful to those who desire to bring about the necessary changes. Such hazards to life and limb should not be allowed to continue.

Yours sincerely,

L. Austin Wright,
General Secretary,
The Engineering Institute of Canada.

Montreal, December 14, 1946.

The General Secretary,
The Engineering Institute of Canada.

Dear Dr. Wright:

It was with great interest that I read your letter, published in the *Gazette,* in connection with the recent wall failure in Montreal.

The appropriateness of your suggestion to force builders, by means of city by-laws, to employ competent contractors and engage engineers to supervise construction might be illustrated by a further example.

I was recently called in to inspect a commercial building erected by the owner without the help of an architect and or engineer. The structure is of steel beams and mill floor. However, the mill floor is not resting on the beams designed for this purpose by the steel supplier, but on the intermediate tie beams which were only designed as lateral braces.

While writing to you I would also like to bring to the attention of the Institute the fact that, very frequently, structural engineers are not engaged for designing buildings in the Province of Quebec, as material suppliers for structural steel and reinforcing steel and general contractors furnish design drawings. A number of steel firms do not even have qualified designing engineers in their organization.

Yours very truly,

Henry Jasen, M.E.I.C.,
Consulting Engineer.

ELECTIONS AND TRANSFERS

At a meeting on December 21st 1946, a number of applications were considered and the following elections and transfers were effected.

Admitted as Students

Students at University of Toronto

W. A. Anderton	M. J. Hutton	R. A. Robertson
W. H. Bacon	R. E. Lashley	R. W. Rogers
L. E. Clark	E. B. MacCuish	B. M. Ross
V. B. Cook	A. M. Mackay	J. A. Sarjeant
L. Dumont	J. M. McLaughlin	G. T. Snider
G. W. C. Easter	R. K. Meharg	A. E. Ticknor
C. H. Eidt	T. J. Mentel	W. L. Walker
A. G. Fairhead	L. K. Narod	C. E. Williamson
G. W. Farnell	L. A. Pattison	G. J. Williamson
B. G. M. Fraser	G. P. Proulx	F. G. Wilson
W. F. Fromm	K. C. Reeves	J. H. Woodrow
W. F. Henwood	J. C. Reinhardt	J. M. Young

Students at McGill University

J. M. Bentham	R. Lanciault	B. Panet-Raymond
S. E. Bryan	A. E. J. Levasseur	M. R. Pollack
R. G. Dye	J. M. Long	H. H. L. Pratley
L. P. Kenyon	J. A. McDonald	S. J. Pressman
M. Kilbertus	R. G. Meek	L. J. F. Savery
D. Kraskinsky	B. J. Morrow	M. Tammaro
L. Laflamme	R. S. O'Neil	

Students at Ecole Polytechnique

C. Belleau	F. Gariepy	L. R. Martineau
G. J. Blain	G. Chabot	F. J. Matusiewicz
G. Charpentier	F. Girard	J. Perreault
L. Desert	A. Guerard	R. Berthiaume
R. Dubuc	J. E. P. Lauzon	J. A. Tourillon
G. Fortin	J. P. Lavigne	G. Turenne
C. Galipeau	R. J. Lessard	J. Vaillancourt
L. Garon		

Students at University of British Columbia

T. R. A. Ald	J. G. Hannan	I. C. Paterson
H. B. Armstrong	J. G. S. Hirtle	E. R. Peterson
D. M. Brousson	W. S. Jackson	D. Quan

J. A. Campbell	J. E. Jones	K. H. W. Seppala
R. N. Denluck	E. T. Kirkpatrick	T. F. Smith
A. J. M. English	J. I. Lessard	D. R. Spray
W. E. Gilbertson	R. A. Malcolm	C. Stanwick
R. N. Gordon	G. N. McLellan	A. G. Tanner
R. D. Grantham	G. B. Milligan	L. H. Vallee

Students at University of Manitoba

H. R. Beck	D. R. Graham	E. I. Lexier
P. A. Brett	J. W. Gunn	G. F. McLean
N. B. Cameron	P. J. Harris	R. W. McLennan
B. R. Davis	T. E. Harris	G. Senyk
C. M. Fung	W. J. Hodge	V. G. Ulrich

Students at University of New Brunswick

B. G. Cameron	R. P. Lynch	W. C. Smith
G. W. Coloris	J. S. MacFarlane	W. M. Steeves
A. S. Demers	R. F. Nicholson	D. F. Taylor
F. G. Lynch	R. R. Ritchie	J. C. F. Wicks

Students at Nova Scotia Technical College

W. G. Baggs — G. E. Knight

Students at Queen's University

B. T. Andrecheck — W. R. Morrissey

By virtue of the co-operative agreements between the Institute and the associations of professional engineers, the following elections and transfers have become effective:

Alberta

Junior to Member

MacLeod, Gordon, B.Eng., (Elect.), McGill, dist. engr., C.P. Communications, Canadian Pacific Railways Co., Calgary, Alta.

Saskatchewan

Member

Hunter, L. H., Kamsack, Sask.

Junior to Member

Smith, Will, National Light and Power Co., Moose Jaw, Sask.
Teskey, Arthur Giles, B.Sc., (Elect.), Manitoba, sales engr., Canadian Westinghouse Co., Ltd., Regina, Sask.

New Brunswick

Members

Collis, Donald, asst. engr., Canadian Pacific Railway Co., Saint John, N.B.
Jardine, Frederic William, B.Sc., (Civil), New Brunswick, Provincial Road Construction, Bathurst, N.B.
Steeves, Roy Talmage, M.Sc., Acadia, asst. dir. vocational education for New Brunswick & engr-architect for Dept. of Education, Fredericton, N.B.
Sweetser, Orland McLellan, Elect. Engr., Pratt Institute, Brooklyn, N.Y., chief engr. & genl. supt., Moncton Electricity & Gas Co., Ltd., Moncton, N.B.

Junior to Member

Eddy, Robert C., B.Sc., (Chem.), Queen's, Murray Street Bathurst, N.B.
Freeman, John Edward, B.Eng., (Mech.), McGill, junior engr., New Brunswick International Paper Co., Dalhousie, N.B.
Lutes, Eric MacPherson, B.Sc., (Civil), New Brunswick, instrumentman, Canadian National Railways, Cape Tormentine, N.B.
Parsons, Robert Lloyd, B.Eng., (Civil), Nova Scotia Tech. Coll., Parsons Construction Co., Ltd., Moncton, N.B.

Nova Scotia

Members

Como, H. E., 411 Charlotte Street, Sydney, N.S.
Moore, Phillip H., consultg. engr., Chester, N.S.

Junior to Member

Ross, Gordon W., B.Sc., New Brunswick, Canadian General Electric, Sydney, N.S.

Quebec

Members

Aboud, Edward Kahill, B.Sc., M.Sc., Toronto, engr., Libby-Long-Aboud, Montreal, Que.
Bell, George Moore, B.Sc., (Elect.), Manitoba, sales engr., Canadian Westinghouse Co., Montreal, Que.
Bengry, Howard F., B.Sc., Toronto, Mine Services, Noranda, Que.

Junior to Member

Budden, John Hastings, B.Eng., (Elect.), McGill, telephone equipt. engr., Northern Electric Co., Ltd., Montreal, Que.

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an operating head of 135 ft. The first three units are expected to be in service in 1951 and the remainder a year later.

A new development was commenced on the Aguasabon River, with power house located at Terrace Bay on Lake Superior. The plant will operate under a head of 297 ft. and will contain two 27,500 hp. units. It will supply a local pulp and paper project, but will also be connected to the Nipigon River plants. An extension of the Ear Falls plant on the English River is also proceeding, the fourth and last unit being under installation. Unit No. 1 at Rat Rapids (1,200 hp.) has been reinstalled. The Kalamazoo Vegetable Parchment Company completed alterations to its water-power plant at Espanola. Three turbines, rated at 2,480 hp. each, have been replaced by a 10,000-hp. turbine driving a 7,500-kva. generator; this change increases the capacity of the plant by 2,560 hp.

During the year, 1150 miles of rural distribution lines and 377 miles of high tension transmission lines were built. Of the latter, 66 miles is accounted for in the line connecting the Thunder Bay System with the Aguasabon development.

Quebec

In Quebec province, the intensive progress in hydro-electric installation during war years has provided adequate capacity for the immediate post-war demand and no new units were placed in operation during 1946.

The Quebec Hydro-Electric Commission, through Beauharnois Light, Heat and Power Company, continued its long range program of dredging operations in the Beauharnois Canal; application has been made for permission to install a 14th unit of 50,000 hp. in the Beauharnois plant. In the Montreal district, a large expansion of substation and distribution facilities is being pushed through to meet substantial increases in loads; additional power will be brought from Beauharnois. In the Temiscamingue and Abitibi district, the Commission has started the construction of a storage dam at Lake Dozois.

During the year, the Shawinigan Water and Power Company carried out extensions to its distribution system, involving an expenditure of about $2,500,000; new work included the construction of about 500 miles of distribution lines; a further $1,000,000 was spent for additions to substations. An important addition to the company's development at Shawinigan Falls has been undertaken; this comprises three additional 65,000-hp. units to be installed in a new power house; this work will cost $12,500,000 and will take at least two years to complete.

The Lower St. Lawrence Power Company has under construction a 6,000-hp. plant on the lower Metis River which will come into operation during 1947. In Saguenay County, the Canadian International Paper Company has a small project under construction which is expected to be in operation about July, 1947. The Gatineau Power Company expects to complete the installation of the fifth and final 24,000-hp. unit in the Farmers Rapids plant early in 1947. Construction was completed of a 36-mile 100-kw. wood pole line from Calumet to St. Jerome.

The Southern Canada Power Company completed

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Personals

News of the Personal Activities of members of the Institute

G. M. Brown, M.E.I.C., district engineer of the Department of Public Works of Canada at Saint John, N.B., will represent the New Brunswick Association of Professional Engineers on the Council of the Institute for the year 1947.

Major R. C. Farrow, M.E.I.C., is the newly elected chairman of the Victoria Branch of the Institute. In 1928 he joined the staff of the Water Rights Branch of the Department of Lands of British Columbia as a hydraulic engineer in the power investigation division, and in 1938 he became chief hydraulic engineer. His activities were interrupted in 1940 when he volunteered for active service with the R.C.E., and he resumed his duties with the Government in 1945. A year later he received the appointment to his present position as comptroller of water rights for the Province.

Prior to service with the Government and after returning from World War I, he was in private practice in Vancouver until 1923, at which time he joined the staff of the Southern California Edison Co. at Los Angeles, Calif. He is chairman of the Pacific North West Section of the Western Snow Conference and vice-chairman of the Committee on the Hydrology of Snow of the American Geophysical Union.

John P. Fraser, M.E.I.C., is the newly elected chairman of the Vancouver Branch of the Institute. He was born in Hamiota, Man., and studied at the University of Manitoba, receiving a bachelor degree in electrical engineering in 1914. Going first to Canadian Westinghouse Company in Hamilton, Ont., he left that company in 1929 as a designing engineer. He was with the Northwestern Power Company then for four years, and in 1933 transferred to the Manitoba Power Commission as a statistical and rates engineer. He became district general manager in 1934 and two years later was general superintendent. Going to the British Columbia Electric Railway in 1940, he was successively superintendent of hydroelectric plants and assistant chief engineer. His most recent appointment was to the position of assistant chief engineer of the electrical operating division of the company.

A. D. Harris, M.E.I.C., chief engineer of the Ford Motor Company of Canada at Windsor, Ont., has been elected chairman of the Border Cities Branch of the Institute. Born in Scotland, he studied at the London Polytechnic Institute. In Canada he was first employed by the Canada Foundry Company Limited, Toronto, on structural draughting, estimates and costs. After four years service with the Canadian Expeditionary Force in World War I, he entered the Canadian Bridge Company Limited, Walkerville, Ont., employed on structural detailing, checking and designing. Going to the Ford Motor Company in 1922 as a design and construction engineer, he became assistant chief engineer in 1930. He went to New Zealand in 1936 as engineer in charge of design, construction and equipment of an assembly branch, returning in 1937. He was appointed to his present position in 1941.

E. G. Wyckoff, M.E.I.C., administrative engineer with the Otis Fensom Elevator Company, Hamilton, Ont., has been elected chairman of the Hamilton Branch of the Institute. Born in Vittoria, Ont., he received a B.A.Sc. degree from the University of Toronto in 1930. He then entered the employ of the company with which he is still connected. Starting as an engineering student at the Hamilton Works, he assumed charge of various manufacturing departments and manufacturing procedures and is now head of the engineering department of the company.

G. W. Lusby, M.E.I.C., is the newly elected secretary-treasurer of the Border Cities Branch. He is an engineer with the Ford Motor Company of Canada at Windsor, Ont. He joined the company in 1927, having been employed previously by the Fraser Brace Company, Gatineau, Que., and by the Canadian International Paper Company at Trois Rivières, Que. Born at Amherst, N.S., he is a graduate of Nova Scotia Technical College, Halifax, having received a B.Sc. in mechanical engineering in 1925.

S. H. Frame, M.E.I.C., is the new secretary-treasurer of the Victoria Branch of the Institute. He is hydraulic engineer for the Water Rights Branch of the Department of Lands and Forests, coming to the Branch in 1928 from the Department of Natural Resources of the Canadian Pacific Railway at Brooks, Alta.

Colonel W. G. Swan, M.E.I.C., Vancouver consulting engineer, and **Colonel H. G. Thompson,** M.E.I.C., manager of Aluminate Chemicals Limited, Toronto, were awarded Alumni Medals at the University of Toronto Alumni Reunion dinner on November 2nd, 1946, for outstanding achievements in the field of engineering.

Lieut. Col. John M. Cape, M.E.I.C., director of E. G. M. Cape and Company, Montreal, took over command of the 34th Field Regiment, R.C.A., at a ceremony held recently at the Montreal headquarters. He served overseas with the R.C.A. from 1940 to 1945. He entered his company in 1934 after graduation from R.M.C., Kingston, Ont.

Dr. R. R. McLaughlin, M.E.I.C., was made head of the department of chemical engineering of the University of Toronto in October 1946. He was formerly professor of chemical engineering, having joined the faculty in 1931 as an assistant professor. An alumnus of Toronto, after receiving a Ph.D. degree in 1926, he performed research at the University until 1929 under the National Research Council. He was president of the Chemical Institute of Canada in 1945.

N. R. Crump, M.E.I.C., general manager at Toronto for Canadian Pacific Railway since January 1946, has been named vice-president and general manager of eastern lines, with headquarters in Toronto. He studied at Purdue University, Lafayette, Ind., specializing in railway mechanical engineering. His railroading career was in the west until 1942 when he was transferred from the position of assistant superintendent of motive power for the west at Winnipeg, to that of assistant to the vice-president at Montreal. He went to Toronto the following year as Ontario general superintendent and was made assistant general manager of eastern lines in 1944.

Digby Wyatt, M.E.I.C., was recently appointed manager of the newly formed Ontario Division of Cresswell Pomeroy Limited, with headquarters at Toronto. He had been regional representative for the Wartime Bureau of Technical Personnel in Toronto from 1942, on leave of absence from his position as industrial combustion engineer for the Elias Rogers Company Limited, Toronto.

W. H. Stuart, M.E.I.C., has resigned as Nova Scotia deputy minister of industry and publicity, and has accepted the appointment as assistant manager of Fred Mannix Construction Companies of Western Canada, with headquarters at Calgary. He became manager of the War Assets Corporation for Nova Scotia in 1944 after service with the R.C.A.F. as manager of the Stanley Flying Training School in N.S., and from that position he went to the post of deputy minister of highways and public works for the province. Mr. Stuart later transferred to the newly created post of deputy minister, Department of Industry and Publicity.

A. C. Eddy, M.E.I.C., chief engineer of way and structures for the British Columbia Electric Railway retired in December 1946, after many years of service with the company which he joined in 1912 as construction engineer, after serving with the Great Northern Railway in charge of construction for extensions of the road in B.C., and as resident engineer in Vancouver. He was made a Life Member of the Institute in November 1946.

Dr. Paul E. Gagnon, M.E.I.C., director of the department of chemical engineering at Laval University, Quebec, will act in an honorary capacity on the interim defence research board recently established at Ottawa. Since 1942 he has been an adviser to the Wartime Bureau of Technical Personnel.

Col. R. D. Harkness, M.E.I.C., vice-president and general manager of the Northern Electric Company Limited, Montreal, will act in an honorary capacity on the interim defence research board newly established at Ottawa. He is industrial representative on the cabinet sub-committee on research for defence.

Dr. C. J. Mackenzie, M.E.I.C., president of the National Research Council is an ex-officio member of the new interim defence research board established at Ottawa.

J. W. Tomlinson, M.E.I.C., of the Manitoba Power Commission was promoted in November 1946 to the position of chief engineer and assistant general manager. He was formerly engineer in charge of construction, supervising the rural electrification programme. He joined the commission in 1937.

R. W. Stickney, M.E.I.C., is now with the Canadian Welding Bureau, a new division of the Canadian Standards Association. He was formerly welding engineer with Canadian Vickers Limited in Montreal.

C. E. Helwig, M.E.I.C., of the faculty of applied science of the University of Toronto, was promoted from the rank of lecturer to that of assistant professor of civil engineering (municipal and structural), in October last. He joined the staff of the University in 1930 as an instructor, after receiving his M.A.Sc. degree.

J. J. Spence, M.E.I.C., was promoted in October last to the rank of assistant professor of engineering drawing at the University of Toronto. A former secretary-treasurer of the Toronto Branch of the Institute, he joined the faculty of applied science at Toronto in 1923.

Douglas E. Covey, M.E.I.C., who has been with the Wayagamack Division of the Consolidated Paper Corporation Limited at Trois Rivières, Que., is now transferred to the Wayagamack 'B' Division of the corporation at Cap de la Madeleine, Que., retaining his official designation as assistant mechanical engineer.

N. C. Cowie, M.E.I.C., former chairman of the Sault Ste. Marie Branch of the Institute has left the employ of the Great Lakes Power Company of that city and has joined the staff of the Abitibi Power and Paper Company Limited at Iroquois Falls, Ont.

J. J. Lefebvre, M.E.I.C., formerly with the Canadian Underwriters Association, Montreal, as fire protection engineer, is now with Irish and Maulson Limited, Montreal, as insurance engineer.

Charles E. Tourigny, M.E.I.C., has left Shawinigan Water and Power Company, to establish a private practice in Montreal. He is president and general director of the Home Family Laundry Inc., and director and consulting engineer of Chaleur Bay Power Limited. With the Shawinigan Company he was manager and editor of the employee magazine, with headquarters at Montreal.

C. H. White, M.E.I.C., has been transferred from the engineering department of Burns & Co. Ltd., at Calgary, Alta., to the engineering department of the company at Winnipeg, Man. He joined the company on his release in 1946 from the R.C.N.V.R.

Guy Beaudet, Jr.E.I.C., has been appointed assistant manager of the Montreal Harbour. He has been with the Central Mortgage and Housing Corporation as Montreal branch manager since early 1946 when he returned from service overseas with the R.C.E. He was city engineer at Thetford Mines, Que., after graduating in 1938 from Ecole Polytechnique, Montreal.

D. D. McLean, Jr.E.I.C., is with the engineering department of Trans-Canada Airlines at Dorval, Que. He was formerly a radio engineer with the Canadian Marconi Company, Montreal.

A. M. Berbrayer, Jr.E.I.C., is employed with the Coast Testing Laboratories Limited in Vancouver, B.C., as an inspection engineer.

H. H. Walker, Jr.E.I.C., is with Waterous Limited, Brantford, Ont. He is employed in the engineering department on design work on pulp and paper machinery.

Obituaries

The sympathy of the Institute is extended to the relatives of those whose passing is recorded here.

Wm. Joseph de Wolfe, M.E.I.C., an employee of the city of Halifax for twenty-five years until his retirement in 1940, died in November 1946 in that city, where he was born in 1873. He was educated in Halifax and commenced his engineering career there with the McKenzie and Mann Construction Company, employed on Halifax and South West Railway surveys. He was appointed in 1904 to the post of resident engineer on construction for the project. In the same capacity he was connected with the James Bay Railway in Ontario in 1906 and with the National Transcontinental Railways in New Brunswick. He became division engineer on construction for the latter, remaining until 1911, when he went to Edson, Alta., as resident engineer on construction for the C.N.R. to Yellowhead Pass. Three years later he returned to Halifax to join the staff of the city engineer and it was in 1928 that he was promoted to the position of assistant city engineer.

Mr. de Wolfe has been a member of the Nova Scotia Association of Professional Engineers since its inception and for a number of years served as its auditor. He was an Associate Member of the Engineering Institute from 1906, and was elected to Life Membership in 1939.

Charles Harvey, M.E.I.C., died on February 5th, 1946, in Toronto, Ont. He was born at Cummingsville, Ont., in 1874, and attended the University of Toronto, graduating as a B.A.Sc. in 1901. He was first employed as assistant on Dominion land surveys and in 1904 opened a practice in civil engineering and land surveying at Kelowna, B.C., during which time he was engineer and surveyor for the Okanagan Falls Land Co., and chief engineer for the Okanagan Power and Development Company. He served in 1917 and 1918 with the C.E.F. and on his return joined the Riordon Company Limited of Temiskaming, Que., as inspector of building construction. He later went to the John V. Gray Construction Company in Toronto as an engineer, and in 1931 he entered the Department of Highways of Ontario as a civil engineer, remaining fifteen years until his death.

Mr. Harvey joined the Institute in 1921 as an Associate Member, becoming a Member in 1940.

Eric S. Sutherland, Jr.E.I.C., of Winnipeg, Man., passed away on October 29th, 1946. He was born in Winnipeg in 1918 and attended school and university in that city, receiving a B.Sc. degree in civil engineering in 1940. He spent vacation periods working for the Newman Construction Company on dam construction and for the Winnipeg Electric Company, where he started as an electrician's helper and later acted as relief foreman in charge of generating equipment. He was awarded a fellowship at the California Institute of Technology but shortly after graduation he enlisted in the R.C.E. and served overseas as a lieutenant. Released early in 1945, he became employed by the Dominion Water and Power Bureau at North Bay, Ont.

Mr. Sutherland, son of D. G. Sutherland, M.E.I.C., Winnipeg industrial engineer, joined the Institute as a Student in 1939, and transferred to Junior in 1946.

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309 miles of rural distribution and an additional 178 miles are under construction. The Dixville power station is being completely overhauled and put in first-class operating condition.

The Northern Quebec Power Company is now installing three 1,000-kva. transformers in place of three 500's previously in use. During 1946, the company constructed lines of 12,000-volt capacity to serve fifteen new mines. The Quebec Rural Electrification Bureau reports that some 188 miles of rural distribution lines have been completed this year and that 625 additional miles are under way.

Maritime Provinces

No new hydro-electric installations were made in the Maritime Provinces during 1946. Tenders have been called by the Nova Scotia Power Commission for a development four miles from Guysborough. The project includes a head dam on Dickie Brook and 6,700 ft. of pipe line to a small power house at tidewater. The average net head will be 297 ft. and installation will consist of two 1,600 hp. units, with provision for a third.

News of the Branches

Activities of the Twenty-eight Branches of the Institute and abstracts of papers presented

CALGARY BRANCH

J. F. Langston, m.e.i.c. - *Secretary-Treasurer*
D. C. Jones, Jr.e.i.c. - - *Branch News Editor*

A regular meeting of the Calgary Branch was held in the Palliser Hotel on December 12th.

S. G. Coultis, introduced a film " Search Unending ", produced by the Imperial Oil Company. He stated that the search for oil was very much more difficult today than it was when seepages indicated the presence of oil. Through the years, oil has become increasingly important in the manufacture of a wide variety of products, including rubber, plastics, abrasives, and many others.

Mr. Coultis believes that there will be similar expansion in the use of natural gas in the future. At present it is being used to produce gasoline, and experiments have proven it a satisfactory material for the production of synthetic soap and a resin much like cellophane.

The film depicts very clearly the modern methods of searching for possible oil-bearing structures. It shows the work of the surface geology and seismograph parties and the laboratory and office study of the field results. Aerial photography is also used to find topographical features which might indicate the presence of oil bearing structures below the surface. Maps are made from seismograph and geological records and a study of them is made to determine whether or not the structure is favorable for the accumulations of oil and gas.

After a drilling site is chosen it is sometimes necessary to build access roads to the site in order to move in the heavy equipment. The picture then showed drilling operations being carried on at a test well.

A second picture, " From Coast to Coast " presented a study of Canadian scenery from the Atlantic to the Pacific.

The meeting was under the chairmanship of H. R. Younger.

EDMONTON BRANCH

W. W. Preston, Jr.e.i.c. - *Secretary-Treasurer*

An electrical method of charting the conditions in a drill hole, recently introduced to Canadian oil fields, was described by Mr. A. A. Perebinossoff, of the Schlumberger Well Surveying Corporation of Houston, Texas, when he presented a paper entitled **Electrical Logging in Bore Holes,** at a meeting of the Edmonton Branch, in the Macdonald Hotel, on November 25th, 1946.

An electrical log, Mr. Perebinossoff explained, is a graph of the resistivity in the materials in the region of the drill hole, recorded as electrodes are moved along the hole. A person trained to interpret the wavy log can correlate the geology in different drill holes, which may be many miles apart; determine the nature of the formations and their thickness; and tell the contents of a reservoir, e.g. whether oil or water.

The illustrated lecture traced the development of electrical logging. The idea originated with Professor Schlumberger in Europe, before he went to the United States. About 1928, an operator had to set up his equipment over a drill hole, fill the hole with liquid or mud, lower three electrodes into the hole, turn on the current, and take readings of resistivity point by point, along the hole. One electrode was at the centre of spheres of equal potential and the other two electrodes, which were connected to a potentiometer, were in different equipotential spheres. By 1932, the logging equipment and automatic recorders were installed in a truck. The speaker claimed that the equipment is getting more complicated every day and that maintenance is a major problem.

The effect of various underground conditions on the log was also described. In porous material the fluid from the hole may " invade " its surroundings and affect the resistivity. Increasing the size of the equipotential spheres may get beyond the region affected, but may then pass through overburden or underburden of a different structure, which again will affect the readings. The present practice is to take two logs. The relative sizes of the hole and equipotential spheres are also important, because of the effect of the mud in the hole on the readings.

In conclusion, the speaker described the logging truck in detail and told how auxiliary equipment is used. Among these are the following—a temperature recorder; a sidewall sampler, in which six bullets force a core punch into the sidewall and a spring returns the core; a depth marker which shoots a radio active bullet; a photo clinometer, which traces the direction and inclination of the hole; and a device which determines the dip and strike of a vein pierced by the drill hole.

Mr. Perebinossoff was introduced to the 48 members present, by Chairman J. W. Porteous, and Dr. J. Allan proposed a vote of thanks, which was carried unanimously.

HAMILTON BRANCH

L. C. Sentance, m.e.i.c. - - *Secretary-Treasurer*
I. M. Macdonald, Jr.e.i.c. - *Branch News Editor*

The annual joint meeting of the Hamilton Branch of the Institute and the Hamilton Subsection of the American Institute of Electrical Engineers took place on Friday, December 13th, 1946, at the Westinghouse Auditorium, with about 135 persons in attendance. John McDiarmid of the A.I.E.E. and E. G. Wyckoff of the E.I.C. were joint chairmen of the meeting.

Mr. H. J. Clyman, the speaker, who was introduced by A. A. Moline, is assistant to the manager of engineering, aviation gas turbine division, Westinghouse Electric Corporation. Mr. Clyman has been active in the development of several Westinghouse gas turbine jet engines, and toured Europe shortly after V-E day to obtain data on German jet propulsion developments.

The application of jet engines to aircraft is a recent development, said the speaker, and its history in the United States begins in 1941. At that time, work was commenced on a gas turbine jet engine, and this same engine was tested less than a year and a half later. This was accomplished in spite of the fact that the designers and builders had not seen any plans or models of a similar design. The engine was an axial compressor type, and performed satisfactorily. Many improvements were made in the original design, such as a reduction in weight, an increase in thrust, and simplifications in the structure and component parts to speed up fabrication. The latest jet engines built by Westinghouse weigh less than 700 lb. and develop 10,000 shaft horsepower at 15,000 r.p.m.

The turbojet is similar to a rocket except that a rocket carries its own oxygen supply. The turbojet, however, has a better specific fuel rate. Jet engines perform more efficiently, and specific fuel consumption decreases, as the speed of the aircraft increases. This makes the jet engine preferable to the reciprocating engine at high speeds, but the reciprocating engine is still more economical at low speds. Jet engines have been used mainly in military aircraft in the past, because of their high speed and light weight, and commercial developments have been small. Jet engines are used at present largely in conjunction with reciprocating engines to assist in taking off with a heavy load.

The first gas turbine in the commercial plane will probably be the gas turbine propeller, or turboprop, and may be used in three or four years. Constant improvements in design are making more shaft horsepower available, and it is believed that a jet engine with a geared down propeller will be widely used.

A very interesting discussion period was held at the completion of Mr. Clyman's talk, after which Neil Metcalf conveyed the thanks of the meeting to the speaker.

NIAGARA PENINSULA BRANCH

P. A. Pasquet, Jr.e.i.c. - *Secretary-Treasurer*
C. A. O. Dell, m.e.i.c. - *Branch News Editor*

The Niagara Peninsula Branch held a November dinner meeting at the Red Casque Inn near Niagara Falls, on Thursday, November 28th, with chairman W. D. Brownlee presiding.

Vice-Chairman M. F. Ker introduced the speaker of the evening, Mr. J. D. Millar, deputy minister of the Department of Highways of Ontario. Mr. Millar gave a very interesting talk outlining the condition of the highways and highway structures of Ontario after six years of wartime traffic, and showing how the Provincial Highways Department is meeting the most urgent needs immediately, and at the same time developing highways for the future. He strongly stressed the need for planning highways for moving the large present and future volumes of traffic over the roads safely, at statutory speeds, and emphasized the need of Canadians becoming "safety conscious" in their driving and in their demands for highway facilities. Mr. Millar stated that the budget for the Highways Department, amounting to $47,000,000 for the current year, was the largest in the history of the province.

After the address several reels of technicolour films were shown which pictured highways and highway construction, including work on the trans-Canada highway which was opened on October 28th this year, and also including aerial photography of Queen Elizabeth Highway.

C. G. Cline, at the close of the meeting, thanked the speaker for one of the most interesting and enlightening talks of the season.

PETERBOROUGH BRANCH

A. R. Hailey, M.E.I.C. - *Secretary-Treasurer*
J. C. Allan, M.E.I.C. - - *Branch News Editor*

The 27th Annual Dinner of the Peterborough Branch of the Institute was held at the Empress Hotel on the evening of November 27th with seventy-five members and guests present.

A. J. Girdwood, chairman of the Branch, briefly introduced those at the head table: E. P. Muntz, past vice-president of the Institute; A. R. Jones; L. Trudel, assistant general secretary; President J. B. Hayes; Vice-president C. E. Sisson; G. C. S. Lucas, assistant chief electrical engineer, B. Pringle, generator engineer and T. F. Robinson, capacitor engineer, of the British Thompson-Houston Company; and Alderman J. Dutton of Peterborough.

Addressing the meeting, Alderman Dutton said that engineers had aided greatly in the development of Peterborough and predicted that they would continue to play an increasing part in the future development of the city. Peterborough, he said, has shown itself to be more planning conscious than most cities in that a high percentage of the citizens had visited the town planning exhibit held in the public library during the previous week. In their planning activities the city council will continue to look to engineers for guidance.

Mr. Louis Trudel, the next speaker, outlined the progress of the Institute during the past year and its present status. With 28 branches and a membership of 8200, it is the largest professional group in Canada.

Mr. Trudel said that community planning should receive the interest of every member of the Institute. Ross Dobbin of Peterborough is the Institute's representative on the newly formed Community Planning Association of Canada.

G. R. Langley introduced the three visitors from the British Thompson-Houston Company of Rugby, England. Mr Lucas spoke of the appreciation of the people of England for the wartime contributions to the common cause by the engineers and people of Canada. Mr. Lucas stated that he believed close co-operation and personal contacts between English and Canadian engineers to be very desirable.

Vice-president C. E. Sisson introduced the president. Mr. Hayes told the members of his satisfaction in visiting all 28 Branches, of which Peterborough was the last on his itinerary, and also in attending the general meeting of Commonwealth Engineers, held in London, England. Mr. Hayes recounted many items of general interest from his visit to England and the Commonwealth Conference.

A disturbing production situation was observed by the president all across Canada, because of strikes and unrest. He ascribed the unsatisfactory situation to war weariness and he called upon engineers to endeavour to lead industry out of that situation by setting a suitable example. He stressed the importance in this regard of turning in an honest day's work every day. In such manner, he concluded, real prosperity can be created.

SAGUENAY BRANCH

J. E. Dyck, M.E.I.C. - *Secretary-Treasurer*

Exploitation of the Caustic Chlorine Industry in Germany was the topic of an address given by Dr. W. C. Gardner to the Saguenay Branch of the Institute on December 5th.

Dr. Gardner was a member of a group of technical men sent to Germany by the American Government to investigate the processes used in that country for the preparation of chlorine and caustic soda.

This group spent four months in Germany and was able to inspect many plants in the occupied zones. Dr. Gardner stated that the Germans had done considerable research on the caustic chlorine process and complete research records on this process had been obtained. The American Government was not interested in confiscating plant equipment for shipment to the United States but rather in obtaining information such as research records, photographs of equipment, etc.

In discussing the methods of making caustic soda and chlorine, Dr. Gardner described the diaphragm process and the mercury cell process. The mercury cell was made in two types, the horizontal cell and the vertical cell. The process in each case was electrolytic and considerable electric current was essential to the process. The vertical type mercury cell had the advantage of requiring considerably less floor space for the same output.

Dr. Gardner illustrated his address with slides showing the various types of cells used in the production of caustic and chlorine.

Since these two products are made simultaneously by the process, it has often been found that to fill the demand for the one product resulted in the other being a drug on the market.

Dr. Gardner was asked whether Germany had been able to keep a sufficient supply of mercury on hand during the war for the mercury cells. It was his opinion that sufficient quantities had been obtained from Spain before the war so that no shortage of this material had resulted.

Many of the slides shown by Dr. Gardner illustrated the devastation in Germany. In some cases plants were operating before the walls and roof had been replaced.

E. F. Hartwick thanked the speaker on behalf of the Branch for an interesting and instructive address.

SAINT JOHN BRANCH

K. W. Salmon, Jr.E.I.C. - *Secretary-Treasurer*
A. R. Bonnell, M.E.I.C. - *Branch News Editor*

The annual meeting of Saint John Branch of the Institute was held in the Admiral Beatty Hotel on the evening of Dec. 12, with L. O. Cass presiding.

Refreshments and dinner were followed by routine business of the year.

After a short discussion on duties on engineering drawings and specifications imported from the United States, it was decided to leave this matter to the Council.

There was no election of officers due to the change in the date of the annual meeting from the spring to the end of the year. Those officers elected last May will hold office until December, 1947.

SASKATCHEWAN BRANCH

D. W. Houston, M.E.I.C. - *Secretary-Treasurer*
L. A. Dokken, M.E.I.C. - - *Branch News Editor*

Members of the Saskatchewan Branch were given a special treat at the dinner meeting held December 12th at the Kitchener Hotel. Mr. Lloyd Bunting of "Ducks Unlimited" presented films on wild life conservation work carried on by his group especially in the field of game birds. The main film "The Big Marsh Lives Again" reviewed, step by step, the measures taken to restore dried up marsh lands which were exploited and drained at various times by land promotion schemes despite the inadequacy of the soil for agricultural purposes. The film dealt in detail with the causes of a high duck mortality rate, and with the steps being taken by this organization, operating on voluntary contributions and on a non-profit basis, to improve the overall situation. A second film on forest management and conservation also proved highly interesting.

Chairman Estlin thanked the speaker and mentioned that the films were most appealing both to engineers and to sportsmen.

Items of business discussed included the proposed Saskatchewan government legislation designed to incorporate professional groups under provincial board control. As little is known of the intended provisions of this legislation our Legislative Committee was instructed to study the problem as thoroughly as may be possible and co-operate fully with other professional groups in the drafting of a suitable brief declaring the stand of the professional man.

A "News-letter" service is to be set up very soon in which all of our members at large as well as those in Regina will be kept posted and up to-date on council activities and general activities of the branch. The announcement that this service was to be given was made by Chairman Estlin, who said that such service would constitute part of the regular duties of the Branch News Editor.

Library Notes

Book notes, Additions to the Library of The Engineering Institute, Reviews of New Books and Publications

BOOK REVIEW

ENGINEERING AND SOCIETY WITH SPECIAL REFERENCE TO CANADA

By C. R. Young, H. A. Innis and J. H. Dales

Reviewed by Professor R. DeL. French, M.E.I.C.,*

Toronto. University of Toronto Press, 1946, 430 pp., one map, paper, $2.25

This book is the outgrowth of lectures delivered to students in engineering at the University of Toronto. Part I, comprising about one-third of the total text and prepared by Dean Young, outlines the profession of engineering broadly, goes into some detail as to its branches and discusses the impacts of engineering on society and of society on engineering.

Part II, written by Professor Innis and Mr. Dales, is a brief economic history of Canada, treatment being by natural geographical divisions of the country. To one not especially trained in economics and political science, a group in which this reviewer unfortunately finds himself, it explains phenomena long apparent to everybody, but seldom so clearly set forth as here. Skilful and economical writing has packed an immense amount of material into little space, without the sacrifice of clarity or apparent commission of anything revelant.

Part I is required reading for all engineers, but especially for those concerned in any way with the education and early training of beginners in the profession. Needless to say, it is also required reading for all students in engineering themselves, and for all those who are contemplating engineering as a career.

Dean Young has handled a difficult subject skilfully; his prose is never tiresome, though dealing with abstracts. His long experience in what is probably the largest school of engineering in the Empire, abundantly qualifies him as the author of what is, so far as this reviewer knows, the first attempt to deal from a Canadian point of view with the problems which vex every student of engineering. It is pleasing to be dependent no longer upon the ideas of authors who, no matter how competent in their own countries, are not necessarily completely in tune with Canadian rhythm.

LIBRARY OPEN THURSDAY EVENING

For the convenience of the Montreal Branch members, the Reference Library will remain open until 8.30 p.m. each Thursday evening when a Montreal Branch meeting is held at Headquarters. Books, etc., may be borrowed and the Library catalogues and indices consulted.

Regular Library Hours

Monday-Friday............	9.00 a.m.— 5.00 p.m.
Thursday.................	9.00 a.m.— 8.30 p.m.
Saturday..................	9.00 a.m.—12.00 noon

Out-of-Town Members

Books, periodicals, photostats, etc., may be borrowed or purchased by any member of The Institute. Postal charges are paid by the borrower. A Five-dollar deposit fee is required before items may be borrowed. Subject bibliographies will be compiled on request. Detailed or extensive literary searches will be made at cost.

ADDITIONS TO THE LIBRARY

TECHNICAL BOOKS, ETC.

Aircraft Lofting and Template Layout with Descriptive Geometry:

Howard Thrasher. San Francisco, Aviation Press, c1942. 212 pp., illus., paper.

Aircraft Production Design:

James E. Thompson. San Carlos, Calif., Aviation Press, c1945. 238 pp., illus., paper.

Applied Elasticity:

John Prescott. N.Y., Dover Pubs., 1946. 666 pp., illus., cloth.

Bell Telephone System:

Arthur W. Page. N.Y., Harper, 1941. 216 pp., illus., paper.

Career Opportunities:

Edited by Mark Morris. Washington, Progress Press, c1946. 354 pp., illus., cardboard.

Concrete Materials and Practice:

L. J. Murdock. London, Edward Arnold; Toronto, Longmans Green, 1946. 320 pp., illus.

Decibel Notation: Its Application to Radio and Acoustics

V. V. L. Rao. Brooklyn, N.Y., Chemical Publishing Co., 1946. 179 pp., illus., cloth.

Efficient Use of Fuel; Prepared under the Direction of the Education Sub-Committee of the Fuel Efficiency Committee of the Ministry of Fuel and Power: forward to American Edition by John C. Olsen.

Brooklyn, N.Y., Chemical Publishing Co., 1945. 807 pp., illus. cloth.

Electric Motor Repair: a Practical Book on the Winding, Repair, and Trouble-shooting of A-C and D-C Motors and Controllers:

Robert Rosenberg. N.Y., Toronto, Murray Hill Books, 1946. 2 volumes in 1, illus., fabrikoid.

Elementary Heat Power:

Harry L. Solberg, Orville C. Cromer, and Albert R. Spalding. N.Y., Wiley, c1946. 480 pp., illus., cloth.

Engineer at Law; a Resume of Modern Engineering Jurisprudence:

Conde B. McCullough and J. R. McCullough. Ames. Iowa State College Press, 1946. 2 volumes, cloth.

Fifty Years of Suretyship and Insurance; the Story of United States Fidelity and Guaranty Company:

Clarke J. Fitzpatrick and Elliott Buse. Baltimore, 1946. 198 pp., illus., cloth.

Higher Mathematics for Students of Chemistry and Physics; with Special Reference to Practical Work:

J. W. Mellor. N.Y., Dover Publications, 1946. 641 pp., illus., cloth.

London Building Law; an Introduction and Guide to the Requirements of the London Building Acts . . . for the Use of Architects, Surveyors and Students . . .

Horace R. Chanter. London, B. T. Batsford, 1946. 358 pp., illus., cloth.

Manual for Aircraft Hydraulics; Theory, Maintenance, and Design:

James E. Thompson and Rodney B. Campbell. San Francisco, Aviation Press, c1942.

Naval Architecture of Planing Hulls:

Lindsay Lord. N.Y., Cornell Maritime Press; Toronto, McLeod, 1946, 305 pp., illus., cloth.

Plastics for Electrical and Radio Engineers:

Walter J. Tucker and R. S. Roberts. London, Technical Press, 1946. 148 pp., illus., cloth.

Principles of Radar; 2nd ed.:

Staff of Radar School, Massachusetts Institute of Technology. N.Y., McGraw-Hill, 1946. v.p., illus., cloth.

Science; Its Effect on Industry, Politics, War, Education, Religion and Leadership:

D. W. Hill. Brooklyn, N.Y., Chemical Publishing Co., 1946. 114 pp., cloth.

PROCEEDINGS, TRANSACTIONS, ETC.

Institution of Electrical Engineers:

Proceedings of the Radiolocation Convention, March-May, 1946, Part IIIA. (Supplement to I.E.E. Journal, Vol. 93. Part 111A. No. 2.)

North East Coast Institution of Engineers and Shipbuilders:

Transactions, Vol. 62, 1945-1946.

TECHNICAL BULLETINS, REPORTS, ETC.

American Society of Civil Engineers. Manuals of Engineering Practice:

No. 19—Water Treatment Plant Design, Prepared by the Com-

*Professor of Civil Engineering, Faculty of Engineering, McGill University, Montreal, Canada.

mittee of the Sanitary Engineering Division on Water Treatment Plant Design, 1939.

Canada. Dept. of Mines and Resources. Mines and Geology Branch:

Publications (1909—1946 inclusive) of the Geological Survey and National Museum. Ottawa, 1946.

Edison Electric Institute and National Electrical Manufacturers Association:

Preferred Voltage Ratings for A-C Systems and Equipment. (E.E.I. Publication No. 0-10.)

Electrochemical Society. Preprints:

90-19—Silicones as Electrical Insulating Materials, Shailer L. Bass, Melvin J. Hunter and T. A. Kauppi.—90-27—Electrodeposition of Cobalt and Nickel from Coordination Compounds, Margaret Davis Kramer, Sherlock Swann, Jr., and John C. Bailar.—90-28—New Addition Agent for the Electrolytic Refining of Tin and Lead, F. C. Mathers and M. M. Felger.—90-29—Thermosetting Vinyl Polymers, E. L. Kropa.—90-30—Service Life of and Gases Evolved from Dry Batteries Stored at 55° C. (130° F.), Walter J. Hamer, John P. Schrodt, and George W. Vinal.—90-31—Study of Equilibrium Reactions in the Leclanche Dry Cell, H. F. McMurdie, D. N. Craig and George W. Vinal. —90-32—Military Applications of Electroplating in World War II, William Blum.

Ingeniors Vetenskaps Akademien. Handlingar:

Nr 187—Forces Exerted on a Rigid Cylinder in a Viscous Fluid between Two Parallel Fixed Planes, O. H. Faxen.
. . . Nr 188—Three-dimensional Theory of Turbine Flow and its Application to the Design of Wheel Vanes for Francis and Propeller Turbines, Ludwig Arthur Dreyfus.

Institution of Mechanical Engineers. Advance Papers—1946:

Free-Piston Compressor-Engines, H. O. Farmer.—Future of Pulverized-Coal Firing in Great Britain, D. H. Sparks.—Investigation of the Airbox Method of Measuring the Air Consumption of Internal Combustion Engines, L. J. Kastner.—Research and Development Applied to Bomb Disposal, H. J. Gough (Thirty-third Thomas Hawksley Lecture).

National Research Council of Canada. Information for the Press:

Release *No. 9—Merchant Marine Radar for Canadian Vessels. —No. 10—Radio Distance Indicator.—No. 11—Progress on the National Research Council's Radiant Heating Project.*

North East Coast Institution of Engineers and Shipbuilders. Advance Papers:

Admiralty Floating Docks: Construction During the 1939-1945 War, F. Hickey.
. . . Application of the Reheat Steam Cycle to Marine Propulsion with Special Reference to the C.P.R. "Beaver" Class Turbo-Electric Cargo Liners, A. W. Davis.

Ohio State University. Engineering Experiment Station:

Bulletin No. 126—Stress-Strain Relations in Ceramic Materials, J. O. Everhart and Marjorie Lassettre.

Purdue University. Engineering Experiment Station. Research Series:

No. 87—Formation, Distribution and Engineering Characteristics of Soils, D. J. Belcher, L. E. Gregg and K. B. Woods of the Joint Highway Research Project.—No. 88—Flow of Water Through 0.50, 0.75, 1.0, 1.5, and 2.0 in. Swing-Check Valves, F. W. Greve and W. C. Killin.—No. 89—Migration and Effect on Frost Heave of Calcium Chloride and Sodium in Soil, Charles Slesser. —No. 90—Hydrogenation of Coal at High Temperatures, J. L. Bray and R. E. Howard.—95—Flow of Liquids Through Vertical Circular Orifices and Triangular Weirs, F. W. Greve.

Svenska Forskningsinstitutet for Cement Och Betong Vid Kungl. Tekniska Hogskolan I Stockholm (Swedish Cement and Concrete Research Institute at the Royal Technical University, Stockholm). **Handlingar:**

Dynamic Method for Determining Average Elastic Properties of Surface Soil Layers, S. G. Bergstrom and S. Linderholm.

U.S. Geological Survey:

Bulletin:—*945-G—Chromite Deposits of the North Elder Creek Area, Tehama County, California.—947-B—Molybdenite Investigations in Southeastern Alaska.—947-C—Nickel Investigations in Southeastern Alaska.—947-D—Geology and Associated Mineral Deposits of Some Ultrabasic Rock Bodies in Southeastern Alaska.—947-E—Copper Bullion Claims, Rua Cove, Knight Island, Alaska.—947-F—Copper Deposits of the Nizina District Alaska.—947-G—Copper Deposits of the Kotsina-Kuskulana District Alaska.—950—Contributions to Geochemistry, 1942-45.*
. . . **Water-Supply Paper:**—*943—Geology and Ground-Water Resources of Scotts Bluff County Nebraska.—985—Surface Water Supply of Hawaii, July 1, 1942, to June 30, 1943.—988—Water Levels and Artesian Pressure in Observation Wells in the United States in 1943; Part 3—North-Central States.—989—Water Levels and Artesian Pressure in Observation Wells in the United States in 1943; Part 4—South-Central States.*

STANDARDS, SPECIFICATIONS, ETC.

British Standards Institution. Codes of Practice Committee:

CP(B) 609—Installation of Domestic Electric Cookers.— CP(B) 610—Installation of Electric Lighting in Schools.—CP(B) 611 —Structural Use of Tubular Steel in Buildings (Tentative).
. . . **British Standards:**—*BS 431: 1946—Manila Ropes for General Purposes.—BS 463: 1946—Sockets for Wire Ropes for General Engineering Purposes.—BC 908: 1946—Sisal Ropes for General Purposes.—BS 1218: 1946—Sluice Valves for Waterworks Purposes.—BS 1335: 1946—Air-Depolarised Primary Cells.*

PAMPHLETS, ETC.

Alcan Chemicals:

Aluminum Co. of Canada, Ltd., Montreal.

High-Frequency Heating in Industry:

Baltimore, Westinghouse Electric and Manufacturing Co., Radio Division. (Reprint No. 4153) from Westinghouse Engineer, July, 1944.)

Housing in Canada; a Factual Summary:

Ottawa, Central Mortgage and Housing Corporation, 1946.

Indexing and Alphabetizing Simplified; with a list of Illustrations:

V. A. Avery and F. Kraines. N.Y., Pamphlet Distributing Co., 1946.

Light Alloy Forgings:

Montreal, Aluminum Co. of Canada, Ltd.

New Involute Spline Standard:

N.Y., Broaching Tool Institute, 1946. (Reprinted from Tool Engineer, November, 1946.)

Pleistocene Deposits of the Shipshaw Area, Quebec:

Robert F. Leggett. (In Trans. R.S.C., Section LV, 1945.)

Positex; a New Form of Natural Rubber Latex with Reversed Charge:

C. M. Blow. London, British Rubber Development Board, 1946. (Positex Pamphlet No. 1.)

Pulp and Paper Facts and Figures; Reference Data:

Montreal, Canadian Pulp and Paper Association, 1946.

Read Rapidly and Well:

R. M. Bear. Yellow Springs, Ohio, Antioch Bookplate Co., c1941.

Saskatchewan. Dept. of Municipal Affairs. Community Planning Branch:

Regulations Respecting the Subdivision of Land. Regina, King's Printer, 1946.

Riveting Aluminum:

Montreal, Aluminum Co. of Canada, Ltd., c1946.

Shortening Eyebars by Heating with an Oxyacetylene Torch:

N.Y., Engineering Foundation, 1946.

Theoretical Analysis of Combustion Gases:

Boleslaw Szczeniowski. (Reprinted from Revue Trimestrielle Canadienne, Autumn, 1946.)

Welding Aluminum:

Montreal, Aluminum Co. of Canada, Ltd., c 1946.

BOOK NOTES

Prepared by the Library of The Engineering Institute of Canada

The Institute does not assume responsibility for any statements made; these are taken from the preface or the text of the book.

ART OF SCALE MODEL AIRCRAFT BUILDING:

V. J. G. Woodason; edited by Walter Buchler. London, Useful Publications, n.d. 110 pp., illus., paper, 4/11, cloth, 8/6.

Scale model-making is not merely a pastime; it has developed into a new industry. This small book is of value to those readers interested in flying who desire to make faithful copies of real aircraft. The instructions and suggestions contained in the book are based on the author's actual experience, accumulated during more than twenty years of model aircraft building. Many sketches and photographs are included, all of Woodason models.

BRITISH STANDARD SPECIFICATION FOR THERMO-SETTING, SYNTHETIC-RESIN BONDED-PAPER SHEET FOR USE IN THE BUILDING INDUSTRY. B.S. 1323-1946:

London, British Standards Institution, 1946. 2/-.

Due to the demand for laminated plastic materials for building and interior decorating, B.S.I. have prepared this specification covering sheet, made with phenolic-type resins, with urea or other aminoplastic type resins, or with both; supplied for use as wall-board or for veneering onto wood or other surfaces, in thicknesses from 1/32 in. to ½ in. Nominal dimensions, tolerances, appearance, flatness, straightness of edges, cross-breaking strength, resistance to impact, to water absorption, marking by hot water, etc., are specified.

CHANGING THE SHAPE OF METALS WITH AN ENGINE LATHE:

Shell Oil Co., Inc. Toronto, Shell Oil Company of Canada, Ltd., c1946. 160 pp., illus., fabrikoid, $7.50.

Written in a simple, concise, logical manner, this book was designed to serve machine-tool, aircraft and automotive parts manufacturers, as well as the entire metal-working industry. It assumes a knowledge of lathe operation on the part of the reader, and was written with the idea that once a man knew why a thing was done in a certain way, he not only could learn how to do it, but often how to do it better.

After outlining the fundamentals of machine tool design and performance, it covers the basic characteristics of lathe construction and operation, and discusses the primary features of different lathe operations, i.e., turning, boring, facing, threading, etc. The book includes in each chapter all the fundamental information necessary to a clear understanding of its subject.

VERTICAL CURVES FOR ROADS, a Textbook for Highway Engineers and Students:

F. G. Royal-Dawson. E. & F. N. Spon, Ltd., London, 1946. 141 pp., diagrs., charts, tables, cloth, 15/4.

This book was written to meet the need for a lucid and comprehensive text book on the subject of Vertical Curves, and covers their functions and design on rational principles to meet the contingencies of modern transport. Treating summit curves and valley curves for one and two-way roads, it contains examples of calculations and their solutions, charts, tables, and formulae. One chapter deals with effect of wheel impact on road obstacles.

The following notes on new books appear here through the courtesy of the Engineering Societies Library of New York, and may be consulted at the Institute Library.

AIRPORTS: Design, Construction and Management:

By H. K. Gliddon, H. F. Law and J. E. Cowles. McGraw-Hill Book Co., New York and London; Toronto, Embassy, 1946. 583 pp., illus., diagrs., charts, tables, 9¼ x 6 in., cloth, $7.00.

The first part of this comprehensive work outlines the requirements and factors entering into the problem of site selection and runway layout. This is followed by a condensed version of the field and laboratory tests and procedure for grading, drainage, and pavement design. Turfing, lighting, radio aids, traffic control, communications, and the basic principles of management are covered. Special features of the book are: a discussion of the role of the United States Government in the design and construction of civil airports; a chapter on obstructions, their lighting and removal; and a 300-page appendix containing full and exact specifications and test procedures for materials and construction methods.

APPLIED ELASTICITY:

J. Prescott. Dover Publications, New York, 1946. 666 pp., diagrs., charts, tables, 8¾ x 5½ in., cloth, $3.95.

Written from the viewpoint of the engineer rather than the mathematician, the mathematical theory is carried out only so far as is necessary for its application to practical problems. General stress-strain relations are first dealt with, followed by a number of chapters on thin rods, thin plates, and cylinders under various conditions of pressure and strain. Separate chapters are devoted to the vibrations of rotating disks and to elastic bodies in contact.

CAREER OPPORTUNITIES:

Edited by M. Morris. Progress Press, Washington, D.C., 1946. 354 pp., illus., 9¼ x 6 in., cardboard, $3.25.

Over a hundred occupations offering substantial possibilities in the post-war world are briefly considered. The information covers the nature of the work involved, the necessary qualifications, how and where to get the proper training and education, and the normal expectation in wages, salary or fees. The fields of industry, business, agriculture, engineering, science, medicine, social work, the arts, education and religion are covered, from the clerical worker and mechanic to the professional man.

EFFICIENT USE OF FUEL:

Foreword for the American Edition by J. C. Olsen. Chemical Publishing Co., Brooklyn, N.Y.; Toronto, General Publishing, 1945. 807 pp., illus., diagrs., charts, tables, 8¾ x 5½ in., cloth, $11.90 (in Canada).

This very comprehensive book, the work of a group of British technologists, covers all aspects of the subject: the composition and properties of all types of fuel; the theories and principles of combustion; the equipment used in burning coal and other solid fuels, fuel oil, and industrial gases; boiler efficiency and testing; water purification and auxiliary boiler equipment; the utilization of steam for industrial processes, central heating, evaporation, etc.; automatic control; and the sampling and analysis of coal and gases. The book is intended both for the student and for the technical man in industry.

ELECTRIC MOTOR REPAIR:

R. Rosenberg. Murray Hill Books, New York and Toronto, 1946. Text, 308 pp.; illustrations and diagrs., 243 pp., 9 x 6 in., paper, loose leaf duo-spiral binder, $5.00.

The construction and operation of the various types of electric motors, both A.C. and D.C., are described in considerable detail. With this groundwork, specific procedures for troubleshooting and repair are given. Over 900 illustrative drawings are included, showing in detail what is treated in the text. The book is so arranged that the text and illustrations are separate so that several pages of text may be consulted while keeping one illustration in view, and vice versa. There is a detailed index.

NAVAL ARCHITECTURE OF PLANING HULLS:

L. Lord. Cornell Maritime Press, New York; McLeod, Toronto, 1946. 305 pp., illus., diagrs., charts, tables, 9¼ x 6 in., cloth, $6.75 (in Canada).

Demands for speedy sea-going planing craft during the recent War led to extensive work on planing hulls, previously largely built by rule-of-thumb and then largely for fresh water use. The author here presents calculations, formulas, charts, graphs and information to give a mathematical basis for the design of sea-going craft that skim the surface of the water.

PRELIMINARY NOTICE

(Continued from page 42)

SPENCER—GEORGE HYLTON of Kingston, Ont. Born at Seaford, England, Nov. 20, 1916. Educ.: graduation diploma R.M.C. 1938, B.Sc. (Civil) Queen's 1939; 1940-42, with R.C.E. as O/C and Staff Officer to chief engr. 1st Can. Army; 1945 (6 mos.) asst. dir. of works & constrn. National Defence Hdqts.; 1946, general staff officer, grade 1, Canadian Staff College, Kingston, Ont. (St. 1938. Jr. 1946).

References: A. J. Kerry, J. L. Melville, K. H. McKibbon, G. R. Turner, D. S. Ellis, W. H. Blake.

SWIFT—JOHN WILLIAM of Montreal. Born at Montreal. Sept. 17, 1912. Educ.: B.Eng. (Mech.), McGill, 1935; with Aluminum Co. of Canada as follows: 1935-37, apprentice training course; 1939-45, fabricating plant supt. i/c of all operations; 1946, mech. engr. doing estimating, designing & specifying work on new fabricating plants in Aluminum Laboratories Ltd., Montreal. (St. 1933. Jr. 1946).

References: N. P. Taylor, M. E. Hornback, D. P. MacNeil, W. L. Pugh, D. G. Elliot, C. L. McLeod, S. R. Banks.

THOMPSON—ARTHUR McCALL of Winnipeg, Man. Born at Medicine Hat, Alta. May 5, 1913. Educ.: B.Sc. (Elect.) Alberta, 1937; with Canadian Gen. Elect. Co. as follows: 1937-42, test course, 1942 to date, elect engr. asst to apparatus divn. manager, Winnipeg, Man. (St. 1937. Jr. 1946).

References: H. E. Briggs, T. E. Story, S. G. Harknett, D. Hunter, L. Hovey, C. Haltalin.

WEIR—WILLIAM CECIL of Hull, Que. Born at Portgage La Prairie, Man. March 24, 1911. Educ.: B.Sc. (Mech.) Sask. 1936; R.P.E. of Ont; 1935-41, engr. Hudson Bay Mining & Smelting Co. Ltd., Flin Flon, Man.; 1941-43, Aeronautical Engr. Officer, R.C.A.F.; 1945 (8 mos.) with 418 sqdn. overseas; at present district constrn. supvr. veterans Land Act, Ottawa, Ont. (Jr. 1937)

References: G. L. McGee, R. E. Hayes, W. L. Cassels, G. R. Goring, R. H. Moore.

FOR TRANSFER FROM THE CLASS OF STUDENT

ZIMMERMAN—G. DOUGLAS of Montreal, Born at Toronto, May 8, 1918. Educ.: B.A.Sc. (Chem.), Toronto, 1943, R.P.E. of Ont; 1943-45, instrument engr. Canadian Synthetic Rubber; 1945-46, Canadian district engr. Fischer & Porter Co. Montreal. (St. 1943).

References: E. W. Dill, G. A. Henderson, K. Rybka, N. Fodor, W. D. Taylor.

PRELIMINARY NOTICE

of Applications for Admission and for Transfer

December 31st, 1946

The By-laws provide that the Council of the Institute shall approve, classify and elect candidates to membership and transfer from one grade of membership to a higher.

It is also provided that there shall be issued to all corporate members a list of the new applicants for admission and for transfer, containing a concise statement of the record of each applicant and the names of his references.

In order that the Council may determine justly the eligibility of each candidate, every member is asked to read carefully the list submitted herewith and to report promptly to the Secretary any facts which may affect the classification and selection of any of the candidates. In cases where the professional career of an applicant is known to any member, such member is specially invited to make a definite recommendation as to the proper classification of the candidate.*

If to your knowledge facts exist which are derogatory to the personal reputation of any applicant, they should be promptly communicated.

Communications relating to applicants are considered by the Council as strictly confidential.

The Council will consider the applications herein described at the February meeting.

L. Austin Wright, General Secretary

*The professional requirements are as follows:—

A **Member** shall have been engaged in some branch of engineering for at least six years, which period may include apprenticeship or pupilage in a qualified engineer's office or a term of instruction in a school of engineering recognized by the council. In every case a candidate for election shall have held a position of professional responsibility for at least two years. The occupancy of a chair as professor, assistant professor, associate professor or lecturer in a faculty of applied science or engineering, shall be considered as professional responsibility.

Every candidate who has not graduated from a school of engineering recognized by the council shall be required to pass an examination as prescribed by council, on the theory and practice of engineering, with special reference to the branch of engineering in which he has been engaged.

A **Junior** shall have been engaged in some branch of engineering for at least four years. This period may be reduced to one year, if the candidate for election has graduated from a school of engineering recognized by the council, in which case he shall not remain in the class of Junior beyond the end of the eighth year after graduation.

Every candidate who has not passed the examinations of the third year in a school of engineering recognized by council shall be required to pass an examination in engineering science as prescribed by council. He shall not remain in the class of Junior beyond age thirty.

A Junior may be transferred to Member without payment of transfer fee providing he makes application before the end of the seventh year after graduation or, if a non-graduate, before attaining age twenty-nine, and his application is approved by council.

Council may extend the above limits if in its opinion special circumstances warrant such extension.

A **Student** shall be at least seventeen years of age, and shall present a certificate of having passed an examination equivalent to the final examination of a high school, or the matriculation of an arts or science course in a school of engineering recognized by the council or shall be required to write examinations as prescribed by the council.

He shall be:

a. pursuing a course of instruction in a school of engineering recognized by the council, in which case he shall be transferred to Junior automatically without payment of transfer fee in the second January after graduation, or

b. receiving a practical training in the profession in which case he shall be transferred to Junior without payment of transfer fee providing he makes application before attaining age twenty-five and his application is approved by council.

He shall not remain in the class of Student after he has attained the age of twenty-five, unless in the opinion of council special circumstances warrant the extension of this age limit.

An **Affiliate** shall be one who is not an engineer by profession but whose pursuits, scientific attainments or practical experience qualify him to co-operate with engineers in the advancement of professional knowledge.

The fact that candidates give the names of certain members as reference does not necessarily mean that their applications are endorsed by such members.

FOR ADMISSION

BRANT—ARTHUR A., 15 Grenadier Heights, Toronto, Ont. Born a. Toronto, Ont. Oct. 3, 1910. Educ.: M.A., Toronto, 1933; 1933-34, Princeton as Queen's Scholar; Ph.D., Univ. of Berlin, Germany. 1936; R.P.E., Ontario (on credentials); with Ontario Dept. of Mines, as follows: 1937, geophysics, 1938-40 i/c geophysics, Steep Rock Lake, 1940-42, oil and gas work; 1944, i/c geophysical exploration, Eldorado Mines; 1945 to date, private consultant in mining exploration & engrg. physics of mining for various mining companies and from 1936 up to present, associate professor of physics & geophysics, Univ. of Toronto.

References: R. F. Leggett, J. T. Wilson, O. Holden, T. R. Loudon, C. R. Young.

BRIGHT—JOHN ERIC, of London, Ont. Born at Portadown, Ireland, Nov. 17, 1910. Educ.: B.Sc., (Mech.), Queen's, 1938; R.P.E. ,Ontario; 1931-33, dftsman., heating, steam & power plants, D. M. Bright, constultg. engr., London, Ont.; 1939, (6 mos.), jr. engr., design & detailing steel structures, London Structural Steel; 1939, (6 mos.), jr. engr., design & detailing, supervising constrn., cranes & monorail misc. mech. equipt., Richards Wilcox Canadian Co.; 1939-46, Engr. Officer, Regimental & Staff, R.C.E.; 1946, (6 mos.), mech. design & dfting., Richards Wilcox Canadian Co.; at present, engineer, Post War Reconstrn., Dept. of Public Works of Canada, London, Ont.

References: H. A. McKay, G. N. Scroggie, W. J. Bright, W. M. Veitch R. Garrett.

BULLOCK—CHARLTON WOODWARD, of Montreal, Que. Born at Winnipeg, Man., June 18, 1922. Educ.: B.Sc., (Engrg.), Univ. of London, Eng. 1941; 1941-42, asst. civil engr., Sir Alex. Gibb & Partners, London; 1942-43, external services engr., Wilson Lovatt & Sons, contractors; with Higgs & Hill Ltd., contractors, 1943-44, asst. civil engr., 1944-45, engr. i/c railways & steam heating; 1945, executive engr. i/c Shagamu-Asha-Ibadam Road; 1945-46, dist. engr., Ibadam, India; H. M. Colonial Engrg. Service, Government of Nigeria; at present, jr. engr., Foundation Co. of Canada, Montreal, Que.

References: G. A. Gaherty, G. H. Thompson, P. Hall, R. F. Shaw, W. Griesbach, R. E. Chadwick.

COGHLAN—ROBERT JAMES, of Winnipeg, Man. Born at Elbow, Sask., June 17, 1917. Educ.: B.Sc., (Mech. Engrg.), Saskatchewan, 1943; R.P.E., Ontario; 1942-46, Lieut. R.C.E.M.E.; 1946 to date, mech. engr., Bailey Meter Co., Ltd., Montreal, Que.

References: E. W. R. Butler, I. M. Fraser, N. B. Hutcheon, G. W. Parkinson.

CUMMINGS—GEORGE LEWIS, of Montreal, Que. Born at Lurgan, N. Ireland, March 10, 1918. Educ.: B.Sc., (Civil), Alberta, 1941; 1941-45, Aero. Engr., Officer, R.C.A.F.; 1945-46, struct. designer, C. D. Howe Co. Ltd., Port Arthur, Ont.; at present, studying at McGill Univ. for Master's degree in Engrg. (Civil).

References: M. J. Fleming, W. C. Byers, R. M. Hardy, I. F. Morrison, R. E. Jamieson, G. J. Dodd.

DeWOLFE—HAROLD ALBERT, of Cornwall, Ont. Born at St. Stephen, N.B., Aug. 21, 1906. Educ.: B.Sc., (Mech. Engrg.), Univ. of Maine, 1930, (accredited E.C.P.D.); 1930-32, student apprentice, Otis-Fensom Elevator Co.; 1935-42, designing engr., Howard Smith Paper Mills; 1942-44, asst. inspectr. Naval Ordnance with British Admiralty Technical Mission, i/c gun proof-range with crew of ten, and partial charge of over 200 examiners at several sub-contractors' plants: with Howard Smith Paper Mills, as follows: 1944-46, designing engr., and at present, asst. mtce. engr., direct charge.

References: H. E. Meadd, D. R. D. Ross-Ross, W. P. Nesbitt, A. L. Farnsworth, W. H. Malone.

FRASER—JOHN NORMAN, of Sydney, N.S. Born at Sydney, N.S. March 14, 1916. Educ.: B.Sc. & App. Sc. Cert., Acadia, 1940; with Dominion Steel & Coal Co., as follows: 1934-35, apprentice pattern-maker, 1935, app. moulder, 1935-36, app. machinist, 1937, dftsman., 1938, sub-foreman, constrn., 1939, blast-furnace helper; 1940, constrn. foreman, Dept. National Defence; with R.C.E., 1940-41, 2/Lt., Works Officer, Coastal Defence, 1941-43, Lieut., Constrn., U.K., 1943-44, Capt. Constrn., U.K., 1944-45, Capt., O. C. Works Section; at present, jr. engr., research dept., Dominion Steel & Coal Co., Sydney, N.S.

References: J. A. Macdonald, J. H. Fraser, H. J. McCann, W. L. Stuewe, N. A. Parlee.

GIBBONS—JAMES FENTON, of Lakeburn, N.B. Born at Boston, Mass., April 10, 1910. Educ.: B.Sc., (Elect. Engrg.), New Brunswick, 1935; with Dept. of National Defence, as follows: 1939, (7 mos.), instru'man., 1939-43, A/C inspectr., A.I.D., i/c, 1943-44, A/C elect. inspectr., i/c Clark Ruse Ltd.; 1944-45, electrician & power house operator, Canadian National Railways, Moncton; 1945 to date, elect. instructor i/c No. 4 Rehabilitation Centre, elect dept., Moncton, N.B.

References: W. Dixon, J. T. Turnbull, A. F. Baird, E. O. Turner, J. A. Moore.

GRASSBY—ROBERT LEIGH, of Winnipeg, Man. Born at Winnipeg, Man., Sept. 26, 1920. Educ.: B.Eng., (Mech), McGill, 1942; 1938-41, (summers), rodman, instru'man., Dept. of Public Works, Manitoba; mach. erection, Manitoba Sugar Co.; mach. mtce., Consolidated Paper Corp.; 1942-45, Commissioned Officer, R.C.E.M.E.; 1945-46, mach. design, estimating, layout, etc., Manitoba Bridge & Iron Works, Winnipeg; at present, engr. grade 2, Dept. of Public Works, Canada, Winnipeg, Man.

References: E. P. Doncaster, G. H. Herriot, G. Fancett, E. V. Gilbert.

GRAVEL—JEAN-PAUL, of Montreal, Que. Born at Montreal, Que. Jan. 19, 1921. Educ.: Taking B.Sc. course at Sir George Williams; student C.P.E.Q., indentured with G. K. McDougall, R.P.E., Quebec; with McDougall & Friedman, Montreal, as follows: 1936-39, dftsman & apprent'ship in design, calculation of heating, plumbing, ventilating, power house, 1936-42, sr. dftsman, i/c dfting, room, calculating & designing heating, plumbing, ventilating, air conditioning, oil piping & inspectn. of jobs under constrn.; 1943-44, Chief Petty Officer, R.C.N.; 1945 to date, McDougall & Friedman, designing, calculating, inspectn., selection of machinery & apparatus for heating, plumbing, ventilating, air conditioning, plwer plant, oil piping, etc.

References: G. K. McDougall, F. J. Friedman, J. D. Fry, D. W. Heywood, R. R. Duquette, J. C. McDougall, F. W. R. Angus, W. L. Yack.

HARDMAN—JOHN, of Lakeburn, N.B. Born at Farnworth, Lancs., England, March 21, 1905. Educ.: Lancashire County Schools, 1910-20; 1920-28, genl. office work & later elect. dept., Steel Co. of Canada, Montreal; 1928-29, aircraft mechanic, Montreal Flying Club; 1929-31, flight engr., & licensed A & C air engr., Canadian Airways; 1931-34, chief engr., Starratt Airways, Hudson, Que.; 1934-38, aircraft engr., Canadian Airways, Western; 1938-42, A & C licensed air engr., Ontario Province Air Service; 1942-44, A B C & D licensed air engr., chief inspectr. & asst. supt. of mtce., Canadian Pacific Airlines; 1944 to date, A B C & D licensed air engr., aircraft inspectr., Trans-Canada Airlines, Lakeburn, N.B. (A & B, before flight & after overhaul, aircraft inspectn.; C & D, before flight & after overhaul, engine inspectn.)

References: J. T. Dyment, B. E. Bayne, T. H. Dickson, W. C. MacDonald.

HELYER—MAURICE, of Vancouver, B.C. Born at Bournemouth, Eng., Nov. 14th, 1887. Educ.: Univ. of California, 1906-08; articled to Myers & O'Brien, structl. engrs., San Francisco; R.P.E., British Columbia; 1906-08, structl. jr. dftsman., part-time while at Univ. of California; 1908-09, levelman, M.W.P.R.R.; 1909-13, designing steel frame & concrete for bldgs. in Vancouver; 1914-15, asst. engr. on constrn. La Point Pier, Vancouver; 1915-19, overseas, 1st Canadian Bridge Co. finishing as Capt., M.C.; 1919-21, estimator, J. G. Coghlan & Sons, shipyards, Vancouver; Ballantyne Pier, Vancouver, as follows: 1921-23, asst. engr. on constrn., 1923-24, structl. design No. 2 elevator; 1924-26, private practice, designed Medical Arts Bldg. & grandstand for Brighouse Race Track; 1926-33, chief engr., E. J. Ryan Contracting Co.; 1933-34, asst. engr. on reconstructn. 2nd Narrows Bridge, Vancouver; 1934 to date, structl. engr. & partner in firm of McCarter & Nairne, architects & structl. engrs., Vancouver, B.C.

References: E. F. Carter, C. P. Pybus, P. B. Stroyan, J. Robertson, A. S. Gentles, W. G. Swan, W. O. Marble, M. L. Gate.

KOZLOWSKI—MELVIN MARIAN, of Lachine, Que. Born at Niagara Falls, N.Y., Jan. 18th, 1919. Diploma, Jr. Engr., Sir George Williams Coll., 1945; at present pursuing course in science at Sir George Williams; 1942-46, mech. dftsman., industrial divn., Dominion Engineering Co., Lachine, Que.

References: J. H. Maude, C. E. Herd, V. Harisay, W. S. McIlquham, H. E. Cunningham.

McGILL—WILLIAM JAMES, of Calgary, Alta. Born at Calgary, Alta., June 14, 1912. Educ.: B.Sc., (Mining & Metall.); M. Sc., (Mining Engrg.) Queen's, 1937 & 1939 respectively; attended California Inst. Technology, Pasadena, 1939-40 (accredited E.C.P.D.); 1936-39, (summers) asst. geologist & geologist for various mining companies; 1940-41, asst. geologist, mine exploration & development, Paymaster Cons. Gold Mines Ltd.; 1941, (6 mos.), asst. supt., plant No. 3, prod. & operation engr., Welland Chemical Works; 1941-45, Aero. Engr., aircraft mtce., R.C.A.F.; 1945 to date; industrial engr., Research & Development Br., Dept. Reconstruction & Supply, Calgary, Alta.

References: B. P. Scull, F. B. Connors, R. M. Hardy, R W. Brews.

MILLAR—JAMES WALLACE, of Vancouver, B.C. Born at Airdrie, Scotland, Oct. 25, 1904. Educ.: B.A.Sc., (Mech.), British Columbia, 1927; R.P.E., B.C.; with Canadian Pacific Railways, as follows: 1929, (7 mos.), dynamometer car operator, 1930-32, asst. chief dftsman., responsible for design of loco. parts & plant machny., etc., 1932-36, shop mech. engr., i/c engrg. shop prod. methods, responsible for mtce. shop equipt., control of costs of tools & mchy., supvr. dftng. office, etc., Weston shops, Wpg., 1936-43, genl. loco. foreman, i/c loco. & car shop, Vancouver; 1943 to date, inspector, Dept. Railways, British Columbia, checking & approv. boiler & pressure vessels designs, etc., etc.

References: W. T. Fraser, W. Rae, W. O. Scott, J. G. Oliver, J. G. D'Aoust, L. B. Stacey.

MOTHERWELL—ROBERT KING, 513 Sherbrooke St., Peterboro, Ont. Born at Ottawa, Ont., March 8, 1917. Educ.: B.Sc., (Mech. Engrg.), Queen's 1942; R.P.E., Ontario; R.C.E.M.E., 1942-43, O. C. Light Aid Detachment, 1943-44, 2 I C Tank Fitters' School, 1944-45, Workshop Officer in N. W. Europe; at present, test course, Canadian General Electric, Peterboro, Ont.

References: G. R. Langley, A. E. MacRae, D. S. Ellis, G. H. Thompson, W. M. Cruthers, F. Bowness.

PEARSE—REGINALD CHARLES, of 144 Percival Ave., Montreal West, Que. Born at Ipswich, Suffolk, Eng., Feb. 15, 1903. Educ.: Grad., Ipswich Municipal & Tech. School; 1918-24, indentured app., shops & drawing office, Ransomes & Rapier Ltd., Engrs., Ipswich; 1925:29, dftsman., Stothert & Pitt, Engrs., Bath, Somerset, Eng.; with Dominion Bridge Co., Lachine, as follows: 1929-30, mech. designer, 1930-40, prod. supvr., genl. foreman, mech. supt., 1941-43, mgr., ordnance plant, Vancouver, 1944 to date, asst. works mgr., and finally, works mgr., Lachine, Que.

References: F. P. Shearwood, R. S. Eadie, J. E. Armstrong, P. L. Pratley, J. G. Notman, H. G. Bertram.

RUSSELL—JAMES REGINALD, 45 De Vere Gardens, Toronto, Ont. Born at Wyebridge, Ont., Dec. 29, 1895. Educ.: Chicago Tech. Coll., 2 yrs.; with Grand Trunk Rly., as follows: 1911-15, apptce'ship., machine shop, 1915-16, engr., pumping stn., rly. constrn., 1919-20, master mechanic, crushed stone plant; 1921-24, dftsman., Detroit Gear & Machine Co.; 1924-26, dftsman., E. Long Ltd., Orillia, Ont.; 1927-29, dftsman. & designer, Carborundum Co.; 1929-39, engr., incl. design & constrn., 3 mos. operation of large lumber mill at Callander, Ont., P. Payette Co.; 1939-40, master mech., Canadian Gypsum Co.; 1940-42, process engr., marine engines, condensers & boilers, John Inglis Co.; 1942-43, engr., Wayman Engrg.; 1943, supt. Midland Foundry & Machine Co.; 1943-44, supt. Davis Automatic Controls; 1944-46, engr., incl. 10 mos on loan to Marathon Paper Co., squad boss (part of time), design & erection of Cellufix plant for Standard Chemical Co., put plant in operation incl. process equipt., bldgs. power plant, etc., Meadows Critoph Co., Toronto; 1946 (Dec.), engr. i/c constrn., Standard Chemical Co., Ltd., Longford Mills, Ont.

References: A. C. Northover, C. A. Meadows, R. W. Emery, W. G. Muir, L. G. McNeice.

SHALES—JOHN STANLEY LENNOX, of Toronto, Ont. Born at Burlington, Ont., Aug. 24, 1919. Educ.: B.A.Sc., (Engrg. Physics), Toronto, 1943 R.P.E., Ontario; 1940-42, (summers), aircraft wood worker, tool designer, Massey-Harris Co., Ltd., Weston, Ont.; 1943, (after graduation), 3 mos., stress analysis, modification request assessing, remaining time i/c modifications to Anson A/C, directing staff of two engrs., six dftsmen., clerks, etc. Federal Aircraft, Montreal; 1944-45, group leader, eventually work on Canadian adaptation engrg. models, such as inter-changeable English & American rockets on Mosquito—left before project completed; in interval decided to leave strictly technical aspects of engrg. & studied hydraulics & diesel engines prior to accepting in July 1946 position of sales engr. Toronto Branch Canadian Fairbanks Morse Co. Ltd., present work, trouble shooting, tech. service designing pump instlns., estimating, supvr. instlns. (selling smallest part of work).

References: C. D. Carruthers, J. F. MacLaren, C. G. R. Armstrong, C. E. Napier, E. M. Proctor, C. A. Meadows, M. J. Lazier.

SLEIGH—EDWARD BARRY, of Leaside, Ont. Born at Hong Kong, China, Aug. 8, 1922. Educ.: B.A.Sc., (Chem. Engrg.), British Columbia, 1944; with Shell Oil Co. of Canada, Ltd., as follows: 1944-46, asst. control of refinery operation, Shellburn, B.C., and at present attached to tech. products dept., handling sale of organic ehemicals & specialty, Toronto, Ont.

References: E. R. Graydon, I. Widdifield, R. H. Self, E. G. Tallman, E. A. Cross.

SWANSON—ROBERT EUGENE, of Vancouver, B.C. Born at Reading, Eng., Oct. 26, 1904. Educ.: Study of steam & mech. engr., 1925-36; R.P.E., B.C., 1927-30, chief engr. i/c mech. staff & dftng. on design of engine & machine parts, etc., Nanaimo Lumber Co.; 1930-35, chief engr. i/c mech. & dftng. staff on machine design, engines & bldgs., power plants, hydro instlns., Kapoor Lumber Co.; 1935-36, chief engr., i/c mech. equipt., over mech. staff & power plants engrs., i/c instlns. & design of power machinery., 1936-40, mech. supt. i/c entire organization, Victoria Lumber & Mfg. Co. Ltd.; 1940-46, inspector, responsible for genl. operation both mech. & operational, all rlys, under jurisdiction of B.C. Gov't., and at present chief inspctr., Department of Railways, Province of British Columbia, Vancouver, B.C.

References: A. R. C. Yuill, W. T. Fraser, G. W. Allan, W. Rae, W. O. Scott W. N. Kelly.

TRACY—WILLIAM RALAND, of Sackville, N.B. Born at Sackville, N.B., Feb. 8, 1921. Educ.: E.Eng., (Mech.), Nova Scotia Tech., 1945; 1941, (summer), mech. helper, International Nickel Co. of Canada; June, 1941-Sept., 1942, inspectr., (4 mos.); prod. clerk, (1 yr.), Canadian Car & Foundry Co.

References: F. H. Sexton, H. W. McKiel, A. E. Flynn, F. L. West, H. A. Ripley.

WILSON—MORTON HOLMES, of London, Ont. Born at Salford, Ont., June 6, 1915; Educ.: B.Sc., (Mech.), Queen's, 1934; with Geo. White & Sons Co., Ltd., London, Ont., as follows: 1934-35, plant engr., 1935-36, prod. supt., 1936-44, genl. supt., 1944 to date, works mgr.

References: W. J. Bright, G. N. Scroggie, A. L. Furanna, H. G. Stead.

FOR TRANSFER FROM THE CLASS OF JUNIOR

CLAWSON—WILLIAM KENNERLEY of London, Ont. Born at Toronto, June 6, 1916. Educ.: B.A.Sc. Toronto, 1940; R.P.E. of Ont.; summer jobs as follows: 1945, miner, McIntyre Porcupine Gold Mines; 1937, asst. to field engr. Toronto York Rds. Commission; 1940-43 with R.C.E. rank of Captain, 2nd. in command field company; 1943-44, Major & Staff Officer, various Hdqts.; 1945-46, contracting engr., designing, estimating of shop built & field erected steel structures, Horton Steel Works Ltd.; at present county engr. & road supt., county of Middlesex, Ont. (Jr. 1944).

References: W. R. Smith, G. H. Crase, R. F. Legget, C. R. Young.

CONNELLY—ALAN BURTON of Ottawa. Born at Amble, England. Mar. 25, 1908. Educ.: graduation diploma, R.M.C. 1931, B.Eng. (Civil) McGill, 1933; 1933-39 with R.C.E. as works officer, Mil. Dist. No. 10, surveys, reinf. concrete, general bldg. constrn. airfields, road, water supply; 1939-46, Deputy Adjutant General, Army Hdqts. Dept. of National Defence, Ottawa. (St. 1932. Jr. 1946).

References: H. Kennedy, J. L. Melville, L. F. Grant, H. L. Meuser, J. P Carriere, H. W. Love, A. J. Kerry.

DAVIES—RICHARD LLEWELYN of Wiarton, Ont. Born at Passburg, Alta. Jan. 12, 1914. Educ.: B.Sc. (Civil) Alberta 1942; R.P.E. of Alberta; 1942 (5 mos.) Jr. engr. Aluminum Co. of Canada, Shipshaw Power Develpt. doing designing, layout of transm. line, concrete inspectn.; 1943 (5 mos.) with Univ. of Alberta, Civil Engrg. Dept. as instructor in the following: hydraulic laboratory, practical problems, adjustments to survey instruments; with Dept. of Transport as follows: May '43—June '45, resident engr. i/c of airport constrn. doing designing, layout of water supply & sewerages for highway to Radio Range Station, Whitecourt, Alta.; June '45—May '46, organizing & training staff of technicians at Univ. of Toronto to carry out soil tests on runway subgrade & materials for various Canadian airports; May 1946 to date, testing engr. for airports, Dept. of Transport, Ottawa, (St. 1941. Jr. 1944).

References: R. M. Hardy, H. P. Keith, W. C. MacDonaod, R. F. Legget, M. D. Mitchell.

FARMER—PHILIP JOHN of St. Catharines, Ont. Born at Vancouver, B.C. Nov. 3, 1915. Educ.: B.A.Sc. (Elec.) B.C. 1939; R.P.E. of Ont. 1939-40, with English Electric Co. of Canada Ltd. as follows: training course including practical shop work, testing of rotating machinery, switchgear & transformers; 1940-42, sales engr. preparation of estimates & tenders with tech. data on apparatus, synchronous, induction & direct current motors & generators; 1942-45, liaison engr. handling details of design, manfg. testing of naval ordnance with Elect. Dept. of R.C.N. & British Admiralty Technical Mission; 1945-46, mgr., order & estimating dept. with same company, St. Catharines, Ont. (St. 1939. Jr. 1946).

References: J. N. Finlayson, H. J. MacLeod, G. Morrison, R. A. H. Hayes A. J. Bennett, D.O.D. Ramsdale.

HOLGATE—DAVID CROSSLEY, of Sault Ste. Marie, Ont. Born at Montreal, Que., March 27, 1915. Educ.: B. Eng., (Civil), 1938; R.P.E., Ontario 1938, structl. steel dftsman. & designer, MacKinnon Steel Corp, Ltd., Sherbrooke, Que.; 1939-41, structl. steel dftsman. & designer, Dominion Bridge Co. Ltd., Toronto, Ont.; 1941 to date, engr. i/c of all design & drawing office work; also asst. to mgr. in co-ordination of work in drawing office, fabrication & erection depths., Sault Structural Steel Co., Ltd., Sault Ste. Marie, Ont. (Jr. 1942).

References: H. P. Wilbur, W. H. M. Laughlin, C. Stenbol, W. D. Adams, A. M. Wilson, E. R. Graydon, E. A. Kelly.

HUBBARD—FREDERICK WILMOT of Kingston, Ont. Born at Burton, N.B. May 15, 1917. Educ.: B.Sc. (Elec.) N.B. 1943; summer work as follows: 1937-42, lathe operator, motor mechanic, transmitting station operator; 1943 (4 mos.), Naval Service, asst to O/C of elect. artificers shop; 1943-45 (18 mos.) Elect. Officer on H.M.C.S. Prince Robert; 1945 (6 mos.) elect. designing, supply & distribution for New Canadian Built Destroyers; Halifax, N.S. 1946, elect. foreman, i/c mtce. for elect. equipt. instruments, & operation of air conditioning equipt., Canadian Industries Ltd., Nylon Div. Kingston Ont. (St. 1943. Jr. 1946).

References: A. F. Baird, M. A. P. Harrigan, E. R. Hammon, R. D. Bennet, E. O. Turner, J. Deane, J. Stephens, T. J. Edwin.

McCOLL—BRUCE JOHN of Montreal. Born at Forest, Ont. March 29, 1918. Educ.: B.Sc. (Mech.) Queen's 1944; with Canadair Ltd. Mtl. as follows: 1944 (5 mos.) power plant engr. working on Consolidated Catalina & Douglas Aircraft (2 mos.), liaison engr. with Douglas Aircraft Co., Santa Monica, Calif. on power plant instlns.; Aug. '44—June '45, power plant designer at Rolls Royce Co. England, June '45—Oct.'45 chief of power plant Canadair section, Mtl., i/c of all design & develpt. for Rolls Royce Merlin Installn. in the D.C.4M.; Dec. '45—June '46 asst. to supvr. design office; 1946, chief of power plant section, Canadair Ltd., engaged in designing and developt. of Aircraft Power Plants. (St. 1943. Jr. 1946).

References: A. Jackson, D. S. Ellis, R. E. Heartz, J. T. Dyment, P. W. Gooch.

PROKOPY—PETER J. of Calgary, Alta. Born at Calgary, Oct. 12, 1915. Educ.: B.Sc. (Civil) Alberta, 1939; 1940-41 engrg. clerk, Dept. of Transport; 1941-42, Jr. engr. Water Resources, Alberta; with Dept. of Transport as follows: 1942-44 instru'man; 1944-45, resident engr.; 1945-46, airway engr.; at present office engr. with Dept. of Asphalt Technology of Imperial Oil, Alberta. (St. 1937. Jr. 1946.)

References: A. L. H. Somerville, H. P. Keith, L. A. Thorssen. R. M. Hardy T. Miard, T. Neumann, H. J. McLeod, P. Hargrove.

RAHILLY—THOMAS FRANCIS of Sault Ste. Marie, Ont. Born at Sault Ste. Marie, April 8, 1916. Educ.: B.Sc. (Mech.) Queen's 1939; R.P.E. of Ont. with Algoma Steel Corp. Ltd. as follows: 1939-41 master mech. blast furnaces; 1941-43, asst. works manager; 1943 to date, asst. supt. mechanical dept., Sault Ste. Marie, Ont. (Jr. 1941).

References: W. D. Adams, C. Stenbol, J. L. Lang, A. M. Wilson, A. H. Russell. *(Continued on page 40)*

Employment Service

The service is operated for the benefit of members of The Engineering Institute of Canada, and for industrial and other organizations employing technically trained men—without charge to either party. It would therefore be particularly appreciated if employers would make the fullest possible use of these facilities to make known their existing or estimated requirements. Notices appearing in the Situations Wanted column will be discontinued after three insertions, and will be re-inserted upon request after a lapse of one month.

Situations Vacant

CIVIL

CIVIL ENGINEER, senior designer, experienced in reinforced concrete and structural steel and general building construction, required to take charge of structuraldesign staff for a firm of consulting engineers in Montreal. Salary $300-$400. Apply to File No. 3585-V.

CIVIL ENGINEERS, from recent graduates up, required by a public utility in Toronto for the design and construction of dams, bridges and power houses. Salary open. Apply to File No. 3736-V.

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ELECTRICAL ENGINEER, recent graduate, required for the engineering staff of a paper mill in the Lake St. John area. Salary open. Apply to File No. 3507-V.

ELECTRICAL ENGINEER with construction experience, required by an electrical contractor in Montreal for estimating, etc. Salary $250. up. Apply to File No. 3720-V.

ELECTRICAL ENGINEER, age about 30, with considerable experience, required by a manufacturer in the St. Maurice Valley. Salary open. Apply to File No. 3723-V.

ELECTRICAL ENGINEERS experienced in the design and installation of private communication systems required for a public utility in Toronto. Salary open. Apply to File No. 3736-V.

ELECTRICAL ENGINEER, with at least five years experience on overhead and underground transmission and distribution systems. Required as distribution engineer by a public utility in Brazil. Salary open. Apply to File No. 3738-V.

ELECTRICAL DESIGNING DRAUGHTSMAN with broad practical experience and theoretical knowledge required for a firm in Quebec. Salary from $225. Apply to File No. 3743-V.

MECHANICAL

MECHANICAL ENGINEERS, preferably with design experience, are required for armament research and development in the Quebec area, in a government establishment. Salary from $190. Apply to File No. 3401-V.

MECHANICAL ENGINEER, under 45, with at least ten years' experience in design of heating, ventilating and refrigeration layouts, required as heating engineer for a government organization on West Coast. Salary $250-300. Apply to File No. 3724-V.

YOUNG MECHANICAL ENGINEERS, with practical experience either in automotive or general manufacturing industries, together with ability to operate engineering office systems, required by an industrial organization in Ontario. Salary open. Apply to File No. 3732-V.

MECHANICAL ENGINEERS, with at least five years' experience in the Pulp and Paper industry required by an Ontario Paper Company. Salary open. Apply to File No. 3733-V.

SENIOR MECHANICAL ENGINEER, ten to fifteen years' experience required by a West Coast manufacturer of heavy equipment and vehicles to take charge of engineering design and inspection departments. Salary about $350. Apply to File No. 3734-V.

MECHANICAL ENGINEERS, with experience in plant layouts and design or ventilation problems or general mechanical design, required by a firm in Quebec. Salary from $250. Apply to File No. 3743-V.

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MINING ENGINEERS, with varied experience required by a firm in Quebec for general mine operation, exploitation and development work. Salary from $250. Apply to File No. 3743-V.

MISCELLANEOUS

CIVIL OR MECHANICAL ENGINEER, required by a pulp and paper company in Newfoundland to look after new development work and general engineering in connection with woods operations. Salary open. Apply to File No. 3655-V.

ASSISTANT PLANT ENGINEER, preferably with pulp and paper or structural design experience, required for a newsprint mill in a city on north shore of Lake Superior. Salary open. Apply to File No. 3657-V.

CIVIL OR MECHANICAL ENGINEERS, recent graduates, required by major oil company engineering Dept. Work consists of design of buildings and miscellaneous equipment for handling petroleum products. Salary open. Apply to File No. 3685-V.

CIVIL OR MECHANICAL ENGINEER, experienced in design and field supervision of construction of industrial buildings, piping, pumping and mechanical equipment, for products distribution of major oil company. Ten years experience required. Salary open. Apply to File No. 3685-V.

JUNIOR CIVIL OR MECHANICAL ENGINEERS with design or structural experience required by a manufacturer of contractors' equipment in the Hamilton area. Salary open. Apply to File No. 3698-V.

JUNIOR ENGINEERS, preferably with some mechanical design experience, required for the engineering staff of a manufacturer in Sherbrooke. Salary open. Apply to File No. 3721-V.

JUNIOR ENGINEERS, recent graduates up, with mechanical background required by a Montreal manufacturer for the design and supervision of boiler plant installations, preferably bilingual. May have sales work. Salary from $200. Apply to File No. 3722-V.

MINING AND METALLURGICAL ENGINEER, age about 30, with considerable experience, required by a manufacturer in the St. Maurice Valley. Salary open. Apply to File No. 3723-V.

INDUSTRIAL ENGINEERS, age 28-40, required by a firm located in Toronto and Montreal for plant inspection and investigation of manufacturing operations. Knowledge of cost accounting, plant construction, machinery, manufacturing methods needed. Travelling involved. Salary open. Apply to File No. 3727-V.

CONSTRUCTION ENGINEER with considerable experience required for the permanent staff of a Montreal inspection company. Salary about $200. Age immaterial. Apply to File No. 3728-V.

JUNIOR ENGINEER, preferably with experience in heating and combustion problems, required by a specialist firm in Montreal. Salary $250-325. Apply to File No. 3729-V.

GRADUATE, interested in economics of iron and steel production and with experience in ferrous metallurgy, required by an organization in Toronto to study the applicability in Canada of various processes of iron production. Salary open. Apply to File No. 3731-V.

PLANT ENGINEER, age about 35, with factory experience and mechanical background, including maintenance and power plants, steam and electrical, required by a manufacturer in Montreal. Salary from $350. Apply to File No. 3735-V.

PLANT MANAGER, age 35-40, with engineering background and management experience, required by a manufacturer in Montreal. Salary from $500. Apply to File No. 3735-V.

SALES ENGINEERS, with mechanical background, bilingual, required by a Montreal firm handling road building and contractors equipment, generators, pumps, etc. Salary open. Apply to File No. 3737-V.

SALES ENGINEERS with electrical or mechanical background required in Toronto for the sale of electrical equipment. Salary open. Apply to File No. 3739-V.

DETAILER AND DESIGNER for reinforcing steel with considerable experience required by a steel fabricating firm in Montreal. Salary open. Apply to File No. 3740-V.

STRUCTURAL STEEL DETAILER AND CHECKER with considerable experience required for checking shop details by a steel fabricating firm in Montreal. Salary open. Apply to File No. 3740-V.

DESIGN ENGINEERS, age about 30, with experience in the design and layout of chemical plants, required by an industrial organization in the St. Maurice Valley. Salary from $250. Apply to File No. 3741-V.

DESIGN DRAUGHTSMEN, age about 25, with experience in chemical plant layouts, required by an industrial organization in the St. Maurice Valley. Salary from $200. Apply to File No. 3741-V.

INDUSTRIAL ENGINEER, with broad experience in plant development, operation, costs and management required for a firm in Quebec. Salary from $250. Apply to File No. 3743-V.

SALES ENGINEER, preferably bilingual, required by a Montreal firm dealing in building materials. Salary from $200. Apply to File No. 3745-V.

The following advertisements are reprinted from last month's Journal, having not yet been filled.

CHEMICAL

CHEMICAL ENGINEER OR CHEMIST, preferably with Ph.D., required by a pulp and paper company with plants in Eastern Canada, for research work. Salary open. Apply to File No. 3549-V.

CHEMICAL ENGINEER required by a pulp and paper company with plants in Eastern Canada, for mill control and pilot plant work. Salary open. Apply to File No. 3549-V.

CHEMICAL ENGINEER OR CHEMIST, from recent graduate up, is required by an industrial concern in Montreal for chemical control of products. Salary open. Bilingual preferred. Apply to File No. 3564-V.

CHEMICAL ENGINEER required by a petroleum refining company in Montreal for process and design work. Salary about $225. Apply to File No. 3575-V.

CHEMICAL ENGINEER required as assistant professor of chemical engineering in a Canadian university to start autumn 1947. Salary open. Apply to File No. 3600-V (D).

CHEMICAL ENGINEERS OR CHEMISTS for analytical work in the laboratory of an industrial firm in Central Ontario. Salary from $175. Veteran preferred. Apply to File No. 3642-V.

CHEMICAL ENGINEER, preferably with sales experience, for sales and service with an industrial firm in Central Ontario. Salary open. Apply to File No. 3642-V.

CHEMICAL ENGINEERS, both with experience and recent graduates, required by an industrial organization in the St. Maurice Valley. Salary open. Apply to File No. 3644-V.

CHEMICAL ENGINEER recent graduate up, to be assistant to the department superintendent of a tar distillery in the Toronto area. Salary $225. Apply to File No. 3674-V.

CHEMICAL ENGINEERS OR METALLURGISTS, with knowledge of French or German, required by a government department for literature researches on industrial problems. Salary about $300. Apply to File No. 3682-V.

JUNIOR CHEMICAL ENGINEER, recent graduate up, required for a paper mill in the Lake St. John area. Salary about $225. Apply to File No. 3684-V.

CHEMICAL ENGINEER with considerable experience in the pulp and paper industry required as chief chemist in a paper mill in Northern Quebec. Salary from $350. Apply to File No. 3684-V.

CHEMICAL OR METALLURGICAL ENGINEERS, from recent graduates up, required by a Quebec firm engaged in metal production for employment as production and development engineers. Salaries open. Apply to File No. 3693-V.

CHEMICAL ENGINEERS with about five years' industrial experience required by a manufacturer in Central Ontario. Salary open. Apply to File No. 3702-V.

CHEMICAL ENGINEER, recent graduate, required as process engineer in production control by a manufacturer in Central Ontario. Salary open. Apply to File No. 3708-V.

CIVIL

CIVIL ENGINEER with experience in the mechanical trades required as designer by a building contractor in Quebec, age 30-35, salary open. Apply to File No. 3444-V.

CIVIL ENGINEER to take charge of work in a drainage district in Quebec. Must be bilingual. May be recent graduate. Salary from $200. Apply to File No. 3479-V.

CIVIL ENGINEER for design work in an industrial plant in the Montreal area with experience in building construction, probably permanent position, salary from $200 up according to experience. Apply File No. 3504-V.

CIVIL ENGINEERS with experience in detailing and designing structural steel and reinforced concrete for manufacturers are required for a steel fabricating company in Manitoba. Salary open. Apply File No. 3519-V.

CIVIL ENGINEERS, recent graduate up, required by a pulp and paper company with plants in Eastern Canada. Salary open. Apply to File No. 3549-V.

CIVIL ENGINEER, age 35-40, with extensive experience in detailing and checking structural steel in buildings and bridges, required by a steel fabricating company in Southern Ontario. Salary open. Apply to File No. 3570-V.

CIVIL ENGINEERS with master's degree, teaching and consulting experience. age 28-40, required for the staff of a unifersity in N.Y. State. Salary open. Apply to File No. 3600-V (C).

CIVIL ENGINEER with construction experience required as plant engineer by a textile firm with headquarters in Montreal. Salary open. Apply to File No. 3615-V.

JUNIOR CIVIL ENGINEER for general construction work with a manufacturer in the province of Quebec. Salary open. Apply to File No. 3672-V.

CIVIL ENGINEER, preferably with railroad experience, required by a company engaged in large scale asbestos production in Quebec to supervise construction of local railroad. Salary open. Apply to File No. 3683-V.

ELECTRICAL

ELECTRICAL ENGINEER, age 32-36, with electrical experience around mines or smelters. English speaking with working knowledge of French, is required by a company in Shawinigan Falls, Quebec. Salary open. Apply to File No. 3415-V.

ELECTRICAL ENGINEER age 30 - 45 with sales training with large manufacturer of electrical equipment instruments and 5-10 years experience as sales service and sales engineer required as sales engineer in Canada for U.S. firm making special equipment for transport and industry. Salary open. Apply to File No. 3447-V.

ELECTRICAL ENGINEERS, from recent graduates up, required by a company in Montreal engaged in the production of telephone, etc., equipment. Veterans preferred. Salary open. Apply to File No. 3551-V.

ELECTRICAL ENGINEER with experience in teaching or practical electrical work required as full-time technical instructor in the Montreal area. Salary open with overtime. Apply to File No. 3600-V. (B).

ELECTRICAL ENGINEER for sales engineering, with previous experience, age 25-40, required by a Montreal firm handling pumps, valves, automatic controls, etc. Salary according to experience. Apply to File No. 3614-V.

ELECTRICAL ENGINEER with knowledge of power apparatus, preferably bilingual, required for sales work with a manufacturer in the Montreal area. Salary open. Apply to File No. 3646-V.

ELECTRICAL ENGINEERS with at least five years experience, mostly in aircraft design, required for the design staff of an industrial organization in Montreal. Salary from $275. Apply to File No. 3650-V.

ELECTRICAL ENGINEER with considerable industrial experience required as a safety engineer by a public utility in the Montreal area. Bilingual preferred. Salary open. Apply to File No. 3654-V.

ELECTRICAL ENGINEER to be chief engineer, responsible for electrical and mechanical design and testing, required by a firm in Ontario manufacturing electric motors. Salary open. Apply to File No. 3656-V.

ELECTRICAL ENGINEER with at least three years experience in the design of generating plants and high tension transformer stations required by an engineering firm in Toronto. Salary open. Apply to File No. 3661-V.

ELECTRICAL ENGINEER with several years experience required as a designer by an industrial organization in Montreal. Salary open. Apply to File No. 3677-V.

ELECTRICAL ENGINEER, with general knowledge of a.c. and d.c. motors, switchgear, mercury rectifiers, transformers and other electrical apparatus, for sales work in Eastern Canada, age 30 to 35, salary open. Apply to File No. 3695-V.

ELECTRICAL ENGINEER, recent graduate, preferably bilingual, required by a public utility in the Ottawa area to learn the distribution business from the management end. Salary open. Apply to File No. 3699-V.

ELECTRICAL DRAUGHTSMAN with several years' experience in industrial layouts for large concern in Eastern Townships. Permanent position and attractive salary available for experienced men. Apply to File No. 3701-V.

ELECTRICAL ENGINEER with construction experience, required by an electrical contractor in Montreal for estimating, etc. Salary $250 up. Apply to File No. 3720-V.

MECHANICAL

MECHANICAL ENGINEER, is required for draughting and detail work with a company in central Ontario. Good prospects for advancement. Single man preferred. Salary open. Apply to File No. 3393-V.

MECHANICAL ENGINEER, with mine mechanical draughting experience, for producing gold mine in Quebec. Apply to File No. 3436-V, stating experience, references and salary expected.

MECHANICAL ENGINEER with experience in pulp and paper work is required as draughtsman for a company in New Brunswick. Salary is open according to qualifications. Apply to File No. 3471-V.

MECHANICAL ENGINEER with paper mill experience for design and layout in connection with the re-conversion of a paper mill in Eastern Quebec. Salary from $200-$350 according to experience. Apply to File No. 3497-V.

MECHANICAL ENGINEER with experience in pulp and paper or mining work required by a pulp and paper company with plants in Eastern Canada. Salary open. Apply to File No. 3549-V.

MECHANICAL ENGINEER from recent graduates up, preferably with paper and pulp experience, required by a firm in the St. Maurice Valley. Salary according to experience. Apply to File No. 3573-V.

MECHANICAL ENGINEER with paper mill or mining experience required as assistant mechanical superintendent and understudy to mechanical superintendent in a paper mill in the St. Maurice Valley. Salary from $300 according to experience. Apply to File No. 3581-V.

MECHANICAL ENGINEER with extensive knowledge of machine shop practice and general industrial experience is required by a specialized industrial plant in the Montreal area. Veteran preferred. Salary according to experience. Apply to File No. 3595-V.

YOUNG MECHANICAL ENGINEER, recent graduate up, single, to be assistant maintenance engineer in a cement plant in South America. Salary about $250 with keep. Apply to File No. 3621-V.

MECHANICAL ENGINEERS to be design squad leaders on heavy machinery design required by a company in Central Ontario. Salary open. Apply to File No. 3623-V.

MECHANICAL ENGINEER recent graduate, required by an industrial firm in south western Quebec, for the design and erection of complex textile machinery. Salary open. Permanent position. Apply to File No. 3625-V.

JUNIOR MECHANICAL ENGINEER with construction or machine shop experience, required in Halifax by a Montreal firm handling heavy construction equipment. Salary open. Apply to File No. 3635-V.

MECHANICAL ENGINEER with experience in machine design required by a firm in the Maritimes engaged in ship repair and conversion and the manufacture of marine and heating equipment. Salary open. Apply to File No. 3638-V.

MECHANICAL ENGINEER with experience in the fabrication of Farm Implements, required by a Quebec firm. Bilingual man preferred. Salary according to experience. Apply to File No. 3666-V.

MECHANICAL ENGINEER with experience in the design of industrial machinery required by a Montreal firm manufacturing custom built machines. Salary $200-$250. Apply to File No. 3669-V.

MECHANICAL ENGINEER with industrial experience required as plant engineer for a plant in central Quebec manufacturing assorted building products. Salary from $250. Bilingual an advantage. Apply to File No. 3671-V.

MECHANICAL ENGINEER with design experience in the pulp and paper industry required by a firm with headquarters in Montreal. Salary $350. Apply to File No. 3673-V.

JUNIOR MECHANICAL ENGINEER with knowledge of precision machine shop practice and aptitude for research work in metals and plastics required for an organization in Toronto for the production of artificial limbs. Must be veteran. Salary from $225. Apply to File No. 3675-V.

MECHANICAL ENGINEER with industrial or construction experience, required by a firm of consulting engineers to inspect machinery deliveries in the Cornwall area. Salary open. Apply to File No. 3691-V.

MECHANICAL ENGINEER, recent graduate up, required for maintenance and production engineering by an industria firm in Montreal. Salary open Apply to File No. 3692-V.

MECHANICAL ENGINEER with considerable experience in chemical plant design and equipment required by a manufacturer in Central Ontario. Salary open. Apply to File No. 3702-V.

MECHANICAL ENGINEERS, age 25-35, required by a manufacturer in Montreal, for training as sales engineers and for executive positions. Salary from $200. Apply to File No. 3710-V.

JUNIOR MECHANICAL ENGINEER, under 30 and preferably bilingual, required by a Montreal firm to train as sales engineer for pumps, engines and allied electrical equipment. Salary open. Apply to File No. 3714-V.

MECHANICAL ENGINEER with experience in tools, dies and shop work required as assistant to the plant manager of a factory in the Montreal area. Duties include obtaining materials. Salary $250-$350. Apply to File No. 3719-V.

MINING

MINING ENGINEER with several years experience required by a company engaged in large scale asbestos production in Quebec. Salary open. Apply to File No. 3683-V.

MISCELLANEOUS

INDUSTRIAL ENGINEER, with engineering background in mechanical, electrical or chemical, age 35 up, bilingual with some practical experience, required by an engineering consultant in Montreal. Apply to File No. 3307-V.

CIVIL OR MECHANICAL ENGINEER with experience in pulp and paper mills, to be assistant to plant engineer in a paper mill in Central Quebec. Salary open. Apply to File No. 3445-V.

TWO STRUCTURAL STEEL DRAUGHTSMEN with five or more years experience in designing and detailing steel structures. State experience and salary required. Location Toronto. Apply to File No. 3451-V.

MECHANICAL OR ELECTRICAL ENGINEER with experience in paper mill or steam plant operation, bilingual if possible, is required by an industrial firm near Montreal. Salary from $300, according to experience. Apply to File No. 3498-V.

RESIDENT ENGINEER with considerable construction experience and bilingual is required by a public utility for employment on the upper Ottawa River. Salary from $350. Apply to File No. 3505-V.

STRUCTURAL STEEL DRAUGHTSMEN AND CHECKERS, preferably graduate engineers but any experienced men acceptable, are required for a steel fabricating company in Manitoba. Salary open. Apply to File No. 3519-V.

MECHANICAL OR MINING ENGINEER, age 30-40 with experience in industrial engineering, required by a large mining and processing firm for methods studies of equipment, labour and costs. Salary according to qualifications. Apply to File No. 3524-V.

ASSISTANT PLANT ENGINEER with paper mill experience required by a pulp and paper company with plants in Eastern Canada. Salary open. Apply to File No. 3549-V.

INDUSTRIAL ENGINEER, under 40, with not less than 5 years' experience in industrial methods engineering, required by a paper company in British Columbia. Salary open. Apply to File No. 3550-V.

GRADUATE ENGINEERS with experience in air-conditioning, heating, refrigeration and allied problems, required by a manufacturer in the Montreal area. Salary open. Apply to File No. 3566-V.

DESIGN ENGINEER with considerable experience required by a pulp and paper firm in the St. Maurice Valley. Salary open. Apply to File No. 3573-V.

CIVIL AND MECHANICAL ENGINEERS AND DRAUGHTSMEN, preferably experienced in building design and plant layout, required for a pulp and paper mill in Southern Ontario. Salary open. Apply to File No. 3578-V.

GRADUATE ENGINEERS, required by a large industrial and chemical organization with headquarters in Montreal for all phases of research design, operation, development, production and maintenance. Salaries open. Apply to File No. 3588-V.

ASSISTANT PROFESSORS AND INSTRUCTORS required for the staff of a technical college in New York State. Salary open. Apply to File No. 3600-V. (A)

MECHANICAL OR ELECTRICAL ENGINEER with considerable construction experience required as executive assistant to chief engineer of general contracting firm with headquarters in Montreal. Salary from $300 according to experience. Apply to File No. 3604-V.

DESIGN ENGINEERS with experience in reinforced concrete and hydraulic structures for hydro-electric developments for an engineering firm with headquarters in Toronto. Salary open. Apply to File No. 3612-V.

CHIEF ENGINEER with industrial experience required for a steel fabricating plant in Western Canada. Salary open. Apply to File No. 3616-V.

STRUCTURAL OR MECHANICAL DRAUGHTSMAN required for detail drawings by a steel fabricating plant in Western Canada. Salary open. Apply to File No. 3616-V.

SALES AND SERVICE ENGINEER with considerable experience in sales and heavy mechanical equipment required by a sales organization on the West Coast. Salary open. Apply to File No. 3626-V.

DESIGN DRAUGHTSMAN for the design of cranes and hoists of all types, capable of making and checking complete manufacturing detail drawing, required by a manufacturer in Southern Ontario. Apply to File No. 3628-V by letter with full details. Salary open.

MECHANICAL OR CHEMICAL ENGINEER for sales and sales engineering of industrial oils and greases, preferably bilingual and with experience in the paper or textile industries, required by an oil company in Montreal. Considerable travelling. Salary from $250. Apply to File No. 3632-V.

QUALIFIED ENGINEER required to represent for sales purposes in Northern Ontario a company engaged in the supply of coal. Knowledge of territory essential. Salary open. Apply to File No. 3634-V.

AERONAUTICAL OR MECHANICAL ENGINEER, recent graduate up, required as owner's representative on aircraft design and manufacture in the Toronto area. Salary open. Apply to File No. 3637-V.

SALES ENGINEER with wide engineering experience wanted by a company in Toronto for the sale of textile machinery and construction equipment. Salary open. Apply to File No. 3639-V.

JUNIOR ENGINEERS, CIVIL OR MECHANICAL, recent graduates up, required for the design staff of a large industrial organization in Montreal. Salary from $175 according to experience. Apply to File No. 3644-V.

MECHANICAL OR AERONAUTICAL ENGINEER with at least five years experience, mostly in design of aircraft power plants or of installations in passenger craft, required by an industrial organization in the Montreal area. Salary from $275. Apply to File No. 3650-V.

CIVIL, MECHANICAL OR AERONAUTICAL ENGINEERS, with some experience in aircraft design or construction, required by an industrial organization in the Montreal area. Salary from $225. Apply to File No. 3650-V.

MECHANICAL AND STRUCTURAL DESIGNERS AND DRAUGHTSMEN required by a pulp and paper company in the Port Arthur district. Salary open. Apply to File No. 3653-V.

ASSISTANT ENGINEER with experience in estimates and specifications for industrial work required by a pulp and paper company in the Port Arthur district. Salary open. Apply to File No. 3653-V.

CHIEF DRAUGHTSMAN with at least five years draughting room and related engineering office experience, preferably in pulp and paper or process industries, required by a pulp and paper mill in the Port Arthur district. Salary open. Apply to File No. 3653-V.

JUNIOR ELECTRICAL OR MECHANICAL ENGINEER required by an industrial firm in Montreal for training as an industrial engineer, including plant layout and maintenance. Salary open. Apply to File No. 3660-V.

MECHANICAL OR ELECTRICAL ENGINEERS for training as production engineers with an industrial firm in Montreal. Salary open. Apply to File No. 3662-V.

CONSTRUCTION ENGINEER with ten years' experience in the design and erection of steel and concrete buildings required for the staff of an oil company in Montreal. Travelling involved. Salary open. Apply to File No. 3663-V.

JUNIOR ENGINEERS preferably with pulp and paper or other industrial experience required for training for the sales staff of a Montreal manufacturer of machines and equipment. Salary from $175. Apply to File No. 3664-V.

GRADUATE ENGINEERS for mechanical design, experimental, test and development departments of a Canadian firm producing aircraft gas turbines. Salary open. Apply to File No. 3667-V.

STRUCTURAL DESIGNERS AND DRAUGHTSMEN required by a firm of consulting engineers in Montreal. Salary open. Apply to File No. 3668-V.

JUNIOR ENGINEERS, recent graduates up, as designing draughtsmen for a brewing company with headquarters in Montreal. Salary from $200. Apply to File No. 3670-V.

SALES ENGINEER with knowledge of sawmill and woodworking equipment, preferably bilingual, required for the sale of specialized equipment. Salary $200 plus commission. Apply to File No. 3678-V.

CHEMICAL OR MECHANICAL ENGINEER, recent graduate required for the service dept. of a chemical industry in Central Ontario. Salary open. Apply to File No. 3680-V.

INDUSTRIAL ENGINEER as field representative in the Toronto-Niagara area for a government department, five to ten years experience. Salary about $300. Apply to File No. 3682-V.

JUNIOR ENGINEER, recent graduate up, required as surveyor by a company engaged in large scale asbestos production in Quebec. Salary open. Apply to File No. 3683-V.

STRUCTURAL STEEL CHECKER OR DRAUGHTSMAN required immediately for a steel fabricating company in Niagara Peninsula. Salary open. Apply to File No. 3687-V.

MECHANICAL OR ELECTRICAL ENGINEER with general industrial experience, preferably with knowledge of time study, required by a wire and cable manufacturing company in Ontario. Salary approximately $225, depending on qualifications. Apply to File No. 3690-V.

SALES ENGINEER, electrical graduate, preferably bilingual, required in Quebec for the sales staff of a firm manufacturing power specialties. Salary open, plus expenses. Apply to File No. 3697-V.

CONSTRUCTION ENGINEER with field experience, age about 30, required as office engineer and assistant to general manager for a firm of contractors in Montreal. Salary open. Apply to File No. 3703-V.

CIVIL OR MECHANICAL ENGINEER with considerable experience in the design and layout of industrial plants required for the design staff of an industrial organization in Montreal. Salary from $250. Apply to File No. 3704-V.

SPECTROSCOPIST with experience in chemical analytical work and the use of the commission spectograph required by an industrial organization with headquarters in Montreal. Salary open. Apply to File No. 3706-V.

FORESTRY ENGINEER, recent graduate up, required by a paper company for woods operations on the Lower St. Lawrence. Salary from $175. Apply to File No. 3707-V.

CHEMICAL, MECHANICAL OR METALLURGICAL ENGINEER, recent graduate up, required by a manufacturer in Central Ontario for construction project work from inception to completion as required. Salary from $200. Apply to File No. 3708-V.

JUNIOR SALES ENGINEER, mechanical background, age 25-30, required by a Montreal firm manufacturing steel tanks, oil drums and other equipment for the oil industry. Salary about $200. Bilingual an advantage. Apply to File No. 3709-V.

JUNIOR ENGINEER DRAUGHTSMAN required by a Montreal firm designing and manufacturing aeroplane equipment. Salary open. Apply to File No. 3712-V.

JUNIOR ENGINEERS, recent graduate up, required for the engineering staff of a communications company with headquarters in Montreal. Veterans preferred. Salary from $175. Apply to File No. 3713-V.

JUNIOR STRUCTURAL DESIGN ENGINEER required by a steel fabricating firm in Central Ontario. Salary open. Apply to File No. 3715-V.

Situations Wanted

GRADUATE CIVIL ENGINEER, M.E.I.C., P.E.Q., 20 years work on Hydraulic Plants as designer and superintendent of construction. Extensive experience in Guniting, diamond drilling and pressure grouting. One month notice. Apply to File No. 1527-W.

INDUSTRIAL ENGINEER—C.E., B.A.Sc., M.E.I.C., age 38, married, bilingual, process development, methods, time study, production control, job evaluation, plant layout, sales. Services available at short notice. Apply to File No. 2157-W.

DESIGN-DRAUGHTSMAN, M.E.I.C. With experience in all classes of Structural Steel detailing and design. Plant layout. Equipment drawings, piping. Paper Mill construction. Wishes change of position to suit experience. Capable of assuming duties of Assistant Chief Draughtsman. Location preferably Montreal, Que. Apply to File No. 2439-W.

GRADUATE ENGINEER, Jr. E.I.C., having proven executive and administrative ability, a liking for and experience in Sales Engineering work, and ten years production and maintenance experience in industry, wishes to locate in the Winnipeg area. Apply to File No. 2500-W.

PART TIME WORK—YOUNG CIVIL ENGINEER, S.E.I.C., would accept some work at night or during spare time; at office or at home. Now engaged in design work during day-time. Apply to File No. 2735-W.

MECHANICAL ENGINEER, S.E.I.C. Class of 1946 age 25, single, bilingual, veteran. Seven months experience in heating and ventilating. Would prefer work including surveys, test installations and service of automatic heating systems, in Montreal area. Available on one-week notice. Apply to File No. 2807-W.

Business Opportunity

MECHANICAL ENGINEER with shop and capital desires partner with experience and capital to set up a Heating, Plumbing and Air-Conditioning Contracting and Engineering Firm in Montreal. Write to File No. 2262-W.

WANTED

SALES ENGINEER

for

Montreal Office

of

Electrical Manufacturing Concern

Must be university graduate of excellent personality and with three to five years' experience since graduation.

Some knowledge of French desirable. Replies will be treated confidentially.

THIS IS AN EXCEPTIONAL OPPORTUNITY FOR THE RIGHT MAN

File No. 3697-V

THE ENGINEERING JOURNAL

THE JOURNAL OF THE ENGINEERING INSTITUTE OF CANADA

VOLUME 30 — MONTREAL, FEBRUARY 1947 — NUMBER 2

"To facilitate the acquirement and interchange of professional knowledge among its members, to promote their professional interests, to encourage original research, to develop and maintain high standards in the engineering profession and to enhance the usefulness of the profession to the public."

★ ★ ★

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CONTENTS

COVER PICTURE

The pulp and paper industry is one of the leading single manufacturing industries of Canada. During the war years, because of the extraordinary demands for munitions, vehicles and certain food products, other industries advanced temporarily to higher positions. The pulp and paper industry, however, is resuming its former place as the leading peacetime industry in Canada. In world trade, pulp and paper are Canada's main commodities except gold; greater than wheat and far greater than nickel. The cover picture is a view of the yards of the International Pulp and Paper Company at Gatineau Mills, Quebec, showing the two-armed stacker and piles of debarked logs.

—*National Film Board photograph.*

OXYGEN ACCELERATED COMBUSTION IN OPEN HEARTH FURNACES

E. T. W. BAILEY, M.E.I.C.
Combustion Engineer, The Steel Company of Canada Limited, Hamilton, Ont.

The author describes tests carried out in the Steel Company of Canada plant at Hamilton using oxygen in an open hearth furnace. Results proved most satisfactory, and he predicts that cheap oxygen foreshadows great industrial changes in the steel and chemical industries.

Men have dreamed of using oxygen in large volumes for melting and heating operations since the time of its discovery by Priestley in 1774. But the high cost of producing the pure gas has always prevented the realization of this dream. The production and use of oxygen has been economical up to the present chiefly for operations such as burning, scarfing and welding, which require relatively small volumes.

Eventually it became known that oxygen at a volumetric purity of 98 per cent could be produced for what appeared to be a cost that justified its use in large volumes. Plans were then discussed with a view to initiating experiments to show what could be accomplished.

The Hamilton plant of the Canadian Liquid Air Company supplies the Hamilton Works of the Steel Company of Canada with oxygen (99.5 per cent) for cutting, scarfing and welding, by means of a system of piping between the two plants. The line pressure averages 160 lb. per sq. in. It was found that by making use of all storage capacity and by operating the oxygen plant at maximum rate on week-ends, when normal consumption was lowest, about 250,000 cu. ft. of oxygen could be provided for experimental use.

A study was made of all the potential consumers of oxygen in the steel plant. The most promising unit, and one that was within the range of the facilities at hand, appeared to be the open hearth furnace. Once it had been decided to apply oxygen experimentally to this furnace, the next step was to work out the details of how to introduce this gas into the furnace system.

Early ideas favoured the introduction of oxygen into the checkers, where it could be added to or could replace a portion of the regular volume of air. For reasons which are explained later, it was decided that cold oxygen could be more effectively introduced directly into the furnace, adjacent to the incoming stream of oil.

Furnace Pressure

It was reasoned the introduction of oxygen would lower the furnace pressure by reducing the volume of products per unit of fuel burnt. Immediate advantage could then be taken of this smaller volume of products, and more fuel could then be burnt and still maintain furnace pressure by arranging dampers in a position to suit the original volume of products. In other words, there was eliminated a substantial volume of nitrogen, which could at once be replaced by regular products of combustion resulting from the burning of extra fuel.

Fuel Rate

The opportunity to burn more fuel at a time when the furnace was coldest appeared desirable. The ability of the furnace to consume a higher rate of fuel input just when it is vitally needed for melting down the cold charge, and when both maximum temperature and calorific input are required, is ordinarily not existant. The reduction in the volume of air required from the checker system per unit of fuel burnt has the added effect of increasing the air temperature.

Oil Ignition

Heavy fuel oils in particular, as all furnace men well know, burn poorly as the furnace becomes colder, even though correct combustion air volumes are supplied. The introduction of oxygen adjacent to the atomized oil seems to entirely eliminate this difficulty. The oil burns or ignites much better than when using standard methods in a very hot furnace. This feature is highly desirable to ensure quick and efficient release of heat to the body of the flame.

Flame Development

The ratio between the port area admitting fuel oil on the one hand and hot air from the checkers on the other hand, is very great. It has always been a source of wonderment as to how fuel oil entering the furnace through a ¾ in. or 1 in. pipe could completely contact a large volume of air entering the furnace through an opening of some 36 sq. ft. It would appear that any method that could concentrate the vital oxygen of the air around the oil stream should improve the all important flame. There were good reasons to believe that a melting flame needed conditioning. It has been said that pre-mixing and burning of fuel with air to get a maximum flame temperature and flame location in a furnace is the most desirable approach of fuel economy. The means at hand to lengthen or shorten a flame to increase or decrease its calorific output, and at the same time to direct its travel, are somewhat limited. The introduction of oxygen along with the flame can be compared to the discovery of a new and useful tool, which will materially add to present means for controlling and conditioning flames.

Refractories

It was reasoned that the proximity and concentration of the oxygen to the oil would localize the heat in the scrap area and prevent direct loss to, or contact with the brickwork. It was felt that no danger to refractories from the hotter flames would exist, so long as any substantial amount of unmelted scrap remained in the furnace. The hot, quickly developed flame would lose its heat so rapidly to the scrap that no excessive furnace temperatures could be produced. It was conceded that the roof and walls of the furnace would probably need careful watching toward the end of the melting period. The introduction of oxygen into the checkers would tend to heat the whole furnace, and means to control direction and intensity of the flame would be curtailed. This method would seemingly shorten refractory life without commensurate advantage to the flame. Tests made by others are reported to have confirmed this supposition.

Description of Open Hearth Furnace

A brief description of the No. 12 furnace, used in connection with the oxygen tests, would seem to be in order. The furnace has a nominal capacity of 175 net tons, and taps around 180 tons. The inside dimensions are 43 ft. 6 in. long and 15 ft. 6 in. wide. The depth below the floor plate level is 30 in. The area at floor plate level amounts to 534.75 sq. ft. There are two checkers at each end, having a length of 23 ft. by 11 ft. 6 in. width and 16 ft. 1 in. width respectively. The mean depth of the checkers is 14 ft. The waste heat boiler of horizontal fire tube design has a nominal rating of 577 bhp. Both forced and induced draft fans are in use. The furnace is equipped with fuel air ratio controls for both oil and gas, automatic reversal control by temperature difference, constant oil flow controller valve and recording flowmeters for air, oil and gas. In addition there is a modern furnace pressure control, actuating louver dampers at the outlet of the induced draft fan.

Early Tests

The first test at the Steel Company of Canada, using oxygen adjacent to the oil stream, was made early in 1942. A ¼ in. dia. copper tube was inserted along the regular burner, so that two streams emerged side by side. This arrangement was only used on one end of the furnace, but even this relatively small amount of oxygen was sufficient to lessen the time required to melt scrap at the end of the furnace in which it was installed, as compared to the opposite end. For obvious reasons no further experimental work was undertaken until after the war.

The next test, and the first one of any real importance, was made on March 10, 1946. This test was also somewhat preliminary in nature. It was intended to indicate what data should be collected and what instruments might be needed to furnish information for tabulation, so as to give an overall picture wherefrom the effects of the oxygen could be studied. Thus, from the observations made, plans were formulated for conducting future tests.

The test consisted of admitting an average flow of 587 cu. ft. per min. of oxygen 3 in. above the stream of fuel oil entering the furnace. A 1 in. pipe was used to conduct both the oil and the oxygen into the furnace. A total of 122,134 cu. ft. of oxygen was consumed over a period of 3 hrs. and 27 minutes. The furnace was reversed on a time basis, and the oxygen valves were manually operated so that flow was practically constant. This precaution was used in order to ease the problem of controlling pressures at the source of supply.

Observation of the flame showed an intense white streak where the steam-oil mixture raced outward from the burner pipe, parallel to the oxygen stream. This 'silver streak' seemed to pre-ignite the oil, so that a brightness was developed in the flame almost as soon as the oil emerged from the burner pipe. No prolonged black core existed in the flame, as is common during the regular scrap melting operation. The flame was intense yet short, and did not extend beyond the middle door.

The roof remained relatively cool. The melting effect on scrap was very interesting. The heavy crop ends soon began to flow and lighter scrap seemed to settle much sooner than usual, and in some respects resembled a brush pile being burnt in the woods. There was general agreement that the speed of melting was materially increased. No special efforts were made to charge the scrap faster than normal, and, as a result, additional scrap was not ready when required. On the basis of this test, the managements of both companies concerned agreed to facilitate further tests as soon as all practical arrangements could be made.

Fig. 1—Open hearth flame without oxygen.

Preliminary Test Notes

Even with the use of oxygen, the amount of extra fuel that can be economically burnt by a furnace is not the maximum fuel it can burn. Increases in fuel input from 35 to 62 per cent above normal were tried, and it appears the optimum amount will settle out at around 40 per cent. Even this is a substantial boost, and accounts for the marked increased speed of melting. A typical pre-test outline is shown by the following figures:

Normal flow of oil—370 U.S. gal. per hr.
Normal flow of air—10,000 cu. ft. per min. to fan.
Theoretical flow of air—9,570 cu. ft. per min. at burner.
Estimated actual flow of air—12,000 cu. ft. per min. at burner.

For the test, the oil flow was increased from a normal 370 U.S. gal. per hr. to 500 U.S. gal. per hr., or by 130 U.S. gal. per hr., which required 663 cu. ft.

Fig. 2—View of burner outlet and open hearth flame with oxygen. (West port.)

per min. of oxygen. A flow of 700 cu. ft. per min. oxygen was selected. Air flow was adjusted to give approximately 2-5 per cent oxygen in flue gases. This amount will vary depending on opening of charging doors. The best flue gas sample is obtained toward the tapping side of the downtake flue.

The following items were measured;—Temperature of air coming from checker at regular intervals after reversal; percent oxygen and combustibles in flue gas; flame index number; steam pressure at stand; oxygen pressure at point upstream from measuring orifice; furnace pressure; weight of scrap, pig iron and stone; tons produced, oil and oxygen used; steam produced and waste gas temperature at checker outlets.

Notes from Second Test

A second major test was made on June 9, 1946, in which a burner was used which had been adapted for combination burning of gas and oil. The oxygen was admitted into the regular gas passage, and formed an annular ring around the oil burner pipe. It was considered this would facilitate in a physical way the uniform and speedy mixture of oxygen and oil. It is interesting to note here that while a pressure of 63 lb. per sq. in. existed in the oxygen line, 75 ft. from the burner, a pressure of minus 34.5 in. water column existed in the annular space through which the oxygen was passing. This type of burner was selected because of its advantage for dual service, as well as to suit the probable delivery conditions of large volumes of oxygen at an estimated pressure of 5 lb. per sq. in.

The second test was highly satisfactory. It was noted that the heats melted hard. This unforeseen condition delayed the final tapping time until adjustments could be made. It was also evident that no standard for judging the improved performance was at hand. The scrap was charged much faster, while records did not show exactly similar heats. Estimates of time required without oxygen, given by first helpers, melters and supervisors, varied considerably. It was therefore decided to run a blank heat and let the operators do all they could to make a heat in as short a time as possible.

Notes and Results on Tests 3, 4 & 4a

The results of tests 3 & 4 using oxygen and the blank heat (4-A) are indicated in Table I.

Table I

Item	*Test No. 3*	*Test No. 4*	*Test No. 4-A*
Total metallic charge—tons	396,430	415,165	399,470
Per cent hot metal	41.9	43.5	41.6
Charging time (hrs.-mins.)	2–45	2–22	3–55
Time to addition of hot metal (hrs.-mins.)	3–18	3-09	5–20
Melt time (hrs.-mins.)	6–50	5–50	7–50
Total time of heat (hrs.-mins.)	8–10	9.05	11–10
Tons produced	179.10	188.95	174.95
Yield—per cent	90.5	91.0	87.6
Tons per hour (charge to tap)	21.9	20.72	15.67
Thousand Btu per ton	2,939	3,486	4,346
Fuel as U.S. gal. oil/net ton	19.49	23.11	28.8
Fuel as Imp. gal. oil/net ton	16.23	19.25	24.0
Fuel rate as oil—U.S. gal. per hr.	500	610	496
Slag, actual FeO %	9.8	6.0	11.5
Rate of flow, oxygen	700	800	None
Cu. ft. of oxygen used	155,700	165,500	None
Cu. ft. of oxygen used per net ton	873	877	None

The average of tests 3 and 4 compared with test 4-A indicates;—

Reduction in time—24 per cent.

Increase in tons per hour charge to tap—36 per cent.

Reduction in fuel 35 per cent.—This is probably higher than can be expected, as fuel was used generously in order to beat the time set by the 'oxygen' heats. Other tests indicate a possible fuel saving of around 17 per cent. The yield on all tests has been consistently high.

Spot tests have been made lately which indicate that on some furnaces the increase in output will exceed 40 per cent. An accurate figure cannot of course be obtained until a given furnace has been operated through a campaign, using oxygen during the melting period of every heat. The life of the furnace under the new conditions is another question mark. Given proper supervision, and assuming a reduction in the extent of the drop in refractory temperatures between heats and during charging, there should be an increase in total time between rebuilds. The consumption of brick per ton of steel should be reduced.

General Observations

In order to keep pace, scrap handling facilities will have to be modernized in many shops if oxygen is used.

While the use of oxygen appears to shorten the scrap melting time by at least 2½ hours, it is probable that the bubbling of oxygen into the bath of molten metal will also substantially lessen the time required for refining. The author has had no experience with this, but it is a scheme that holds promise.

If 98 per cent oxygen can be produced in large volumes for around 25c per thousand cu. ft., its arrival as a cheap plentiful gas heralds great industrial changes. In a steel plant it can be used to materially increase the capacity of any gas producer or heating furnace. Existing boilers may be forced to produce unheard of amounts of steam, while blast furnace gas may become a rich fuel. In the chemical industry, the output of sulphuric acid could be increased fivefold, even with existing equipment. These things now seem somewhat fanciful, but it *is* interesting to find a way to heat an object, without expending so much energy to heat large volumes of unwanted nitrogen.

Some day it may be quite possible to build an open hearth furnace without checkers, and to obtain even higher efficiencies than are possible with existing units. Yet to fuel engineers and operating supervisors, the advent of oxygen will but add another item for which cost must be kept down. The free air will disappear.

Devices and instruments for control will have to be designed. Oxygen is difficult to meter, since the mercury used as a manometer seal becomes oxidized. Displacement meters are bulky and costly. The use of silicone as a manometer seal or bellows might prove to be the answer to this problem. Instruments recording the percentage of oxygen in the flue gas will be essential on each furnace, and there will be a real need for a small dependable recorder for this service.

ANALYSIS OF AN ARCH SUPPORTED CONTINUOUS GIRDER

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This paper has been condensed from a thesis by the authors in part fulfilment of the requirements for their Masters Degree. It deals with a type of structure which, although highly indeterminate, may well become a useful and attractive type for bridges with spans of 300 to 600 ft. The process of solution is new for this type of structure, and presents an interesting method of attack for other indeterminate structures. It consists of a recognition of certain equations, which arise naturally, as "difference equations", and in the application of the methods of the calculus of finite differences to the solution of them. Those interested in structural analysis should find this paper stimulating. Because of its condensed form, it requires careful reading.

Introduction

An arch-supported continuous girder, more commonly known as a tied arch, resembles the ordinary arch bridge so widely used today. Because this structure has a lower chord which will carry moment, thrust and shear, the engineer can distribute the moment both to the rib and to the girder. This at once allows the use of heavier members in the chords and lighter rib members, which is, in itself, an obvious advantage in construction. The rib and girder, being stable within themselves, require only light hangers to distribute the moment. Moreover, the elimination of the usual diagonals adds to the aesthetic qualities of the truss.

This type of structure, though common in Europe, is relatively new to this continent. There are consequently few methods of analysis available in our literature. The general approach has been to use the differential calculus, with necessary assumptions and approximations. European literature, on the other hand, indicates that the calculus of finite differences offers a powerful approach to such an analysis. This is especially true where concentrated loads occur at regular intervals. In the following article, a "difference equation" has been used to obtain a general analysis of the tied arch.

Type of Structure

The structure to be dealt with (Fig. 4) consists of an arched rib held together by a tie girder which, in turn, is supported at regular intervals from the arch by vertical hangers connected to the rib at the panel points. For the purpose of analysis, the girder and rib will be considered to be pin-connected, and the structure as a whole to be simply supported. Both rib and girder can take moment, thrust, and shear, while the hangers are restricted to tensile stress only. In order to have a load system of concentrated forces occurring at regular intervals, the floor beams are assumed to frame into the girder at the panel points.

With the use of the following notation the degree of indeterminateness may be obtained.

Let n = number of panels
k = number of joints (= $2n$ in this case)
r_1 = number of stiff members (= $2n$)
r_2 = number of simple members = $(n\text{-}1)$
e = number of stiff corners = $2(n\text{-}1)$

Degree of indeterminateness is

$r_1 + r_2 + e - 2K + 3 = N.$

Therefore, $N = 2n + (n\text{-}1) + 2(n\text{-}1) - 4n + 3 = n$ and the system is indeterminate to the n^{th} degree. If the connections between the girder and rib are not pinned, then $e = 2n$ and $N = n+2$.

Assumptions

The computations are carried out on the basis of the following assumptions:

1. All members are considered straight between the panel points.
2. The loads are vertical and may come on the structure only at the panel points.
3. The moments of inertia of all members between panel points will be constant and will be so chosen that the relation

$$\frac{I_r^R \cos \phi_r}{I_r^G} = \alpha$$

will be a constant throughout the structure.
4. The hangers are slender pin connected members, restricted to tensile stresses only, and are assumed not to change in length. This is the usual assumption.
5. The bottom chord is horizontal, though computations are not appreciably affected by a small camber in the girder.
6. Deformations due to normal and shearing stresses are neglected throughout.

Notation

A = Area of cross section.
A_r^G = area of the r^{th} member in the girder.
A_r^R = area of the r^{th} member in the rib.
E = Modulus of elasticity (assumed constant for the entire structure).
H = Horizontal component of rib compression or tie tension.
I = Moment of inertia.
I_r^R = the moment of inertia of the r^{th} member in the rib.
I_r^G = the moment of inertia of the r^{th} member in the girder.
ϕ_r = Slope of the arch rib in the r^{th} panel.
h_r = Rise of the arch rib at the r^{th} panel point.
L = Length of the panel.
M_r' = Simple beam moment at the r^{th} panel point.
M_r^t = The total bending moment to be resisted by the girder and tie at the r^{th} panel point $= (M_r' - Hh_r)$
M_r^G = The moment to be resisted by the girder at the r^{th} panel point.
M_r^R = The moment to be resisted by the rib at the r^{th} panel point.
$\overline{M}$ = The moment due to a unit couple.
$\overline{N}$ = The direct stress in any member of the structure due to $H = 1$.
$\alpha = \dfrac{I_r^R \cos \phi_r}{I_r^G}$

Analysis

The necessary and sufficient conditions for determining the redundant forces and bending moments in a structure, indeterminate to the n^{th} degree, are that $n+3$ independent linear equations containing these unknowns be obtained. In general, the n equations (in addition to the three equations of statics) are most satisfactorily obtained from the work equations. These equations, obtained from the law of Virtual Work, may be expressed algebraically as:

$$\theta = \sum \int \frac{\overline{M}\, M dx}{EI} \quad . \quad . \quad . \quad . \quad . \quad . \quad (1)$$

i.e. the change in angle at the point of the application of a unit couple.

$$\delta = \sum \int \frac{\overline{M}\, M dx}{EI} + \sum \int \frac{\overline{N} N dx}{AE} \ * \quad . \quad . \quad . \quad (2)$$

i.e. the deflection at the point of application of a unit load.

The expression $\int \frac{\overline{M}\, M dx}{EI}$ may conveniently be evaluated by the moment-area method. This is especially true if one of the bending moment curves is a trapezoid.

Consider a straight beam which may not have a constant moment of inertia over the whole span.

Then the equation $\delta = \int_0^l \frac{\overline{M}\, M dx}{EI}$ may be multiplied by any constant moment of inertia I_o so that for convenience

$$EI_o\delta = \int_0^l \frac{\overline{M} M I_o dx}{I} \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (3)$$

The multiplication of either bending moment by $\frac{I_o}{I}$ gives an area between the bending moment curve and the OX axis, called a modified M-surface. Referring to the bending moment diagrams for the unit load at a

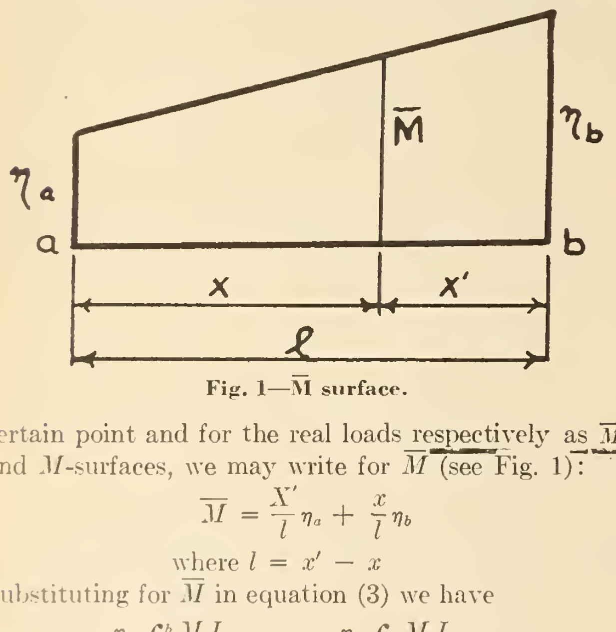

Fig. 1—$\overline{M}$ surface.

certain point and for the real loads respectively as $\overline{M}$- and M-surfaces, we may write for $\overline{M}$ (see Fig. 1):

$$\overline{M} = \frac{X'}{l}\eta_a + \frac{x}{l}\eta_b$$

where $l = x' - x$

Substituting for $\overline{M}$ in equation (3) we have

$$EI_o\delta = \frac{\eta_a}{l}\int_a^b \frac{M\, I_o}{I} x' d\, x' + \frac{\eta_b}{l}\int_a \frac{M\, I_o}{I} x dx$$

but $\int_a^b \frac{M\, I_o}{I} x' dx'$ and $\int_a^b \frac{M\, I_o}{I} + dx$

are statical moments of the modified M-surface, which may be simplified in the case of a trapezoidal M-surface to

$$S_{Ba} = \frac{\xi_a (l)^2}{6} + \frac{\xi_b (l)^2}{3}$$

$$\text{and } S_{Bb} = \frac{\xi_a (l)^2}{3} + \frac{\xi_b (l)^2}{6}$$

as in Fig. 2.

*The terms containing changes of temperature have been neglected.

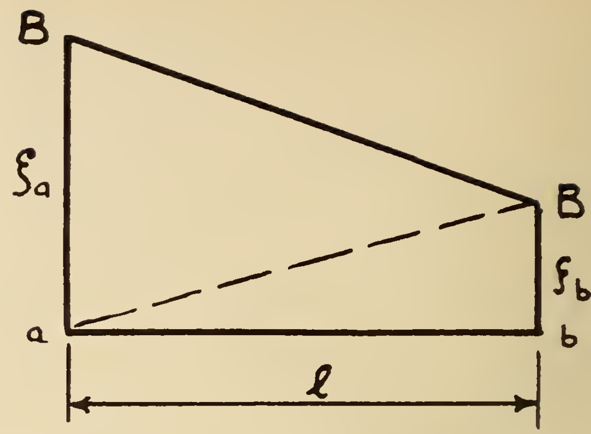

Fig. 2—M surface. As a trapezoid.

$$\text{Thus, } EI_o\delta = \frac{\eta_a l}{6}(2\xi_a + \xi_b) + \frac{\eta_b l}{6}(\xi_a + 2\xi_b) \quad . \quad . \quad . \quad (4)$$

The analysis now resolves itself into the solution of two main problems.

(a) The determination of the division of the total moment between the rib and girder.

(b) The determination of the horizontal components of the longitudinal forces in the chord members.

The computation for (a) takes place by the use of the first of the work equations. The $\overline{M}$ surface in this case is that due to a unit couple placed at the panel point.

Then using equation (4), and the notation as given, the change of angle for the top chord at the r^{th} panel point is (see Figs. 3a and 3b):

$$\theta = \frac{L}{6EI_r^R \cos \phi_r}(M_{r-1}^R + 2M_r^R)$$

for the lower chord at the r^{th} panel point

$$\theta = \frac{L}{6EI_r^G}[M_{r-1}^t - M_{r-1}^R + 2(M_r^t - M_r^R)]$$

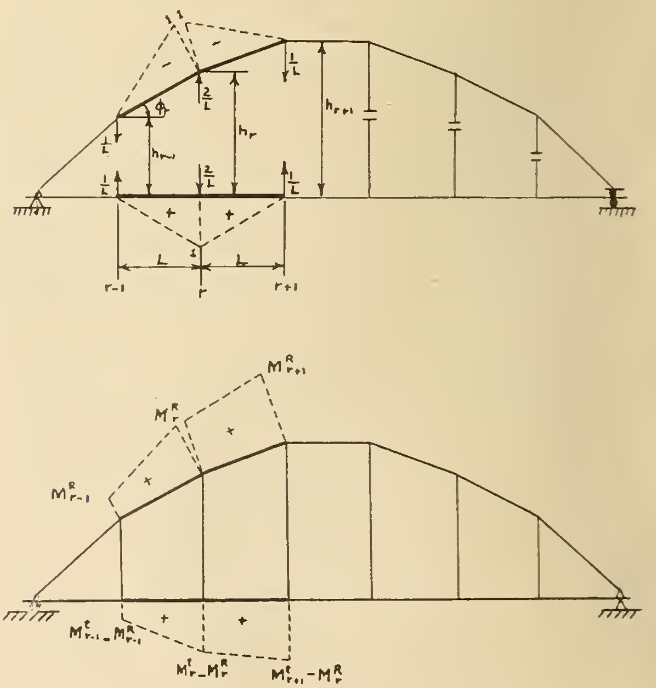

Fig. 3—(a) $\overline{M}$ surface on the statically determinate structure. (b) M surface on the statically indeterminate structure.

Since the hangers are assumed to have no change of length, θ for the top chord $= \theta$ for the lower chord at the same panel point.
Then:

$$\frac{L}{6EI^R_r \cos\phi_r}\left[M^R_{r-1} + 2M^R_r\right] =$$

$$\frac{L}{6EI^G_r}\left[M^t_{r-1} - M^R_{r-1} + 2M^t_r - 2M^R_r\right]$$

From which

$$(M^R_{r-1} + 2M^R_r) = \frac{\alpha}{1+\alpha}\,(M^t_{r-1} + 2M^t_r)$$

Similarly, at the $r+1$ panel

$$(2M^R_r + M^R_{r+1}) = \frac{\alpha}{1+\alpha}\,(2M^t_r + M^t_{r+1})$$

Adding, we have:

$$(M^R_{r-1} + 4M^R_r + M^R_{r+1}) = \frac{\alpha}{1+\alpha}$$

$$(M^T_{r-1} + 4M^t_r + M^t_{r+1})$$

The general solution of this difference equation is:

$$M^R_r = C_1\,(K_1)^r + C_2\,(K_2)^r + \frac{\alpha}{1+\alpha}\,M^t_r$$

where K_1 and K_2 are the roots of the characteristic equation

$$(K)^2 + 4K + 1 = 0$$

and C_1 and C_2 are constants to be determined from the boundary conditions.

Also, since, $K_1 \,.\, K_2 = 1$ we may write

$$M^R_r = C_1\,(K)^r + C_2\,(K)^{-r} + \frac{\alpha}{1+\alpha}\,M^t_r$$

and since $M^t_o = M^t_n = 0$ and $h_o = h_n = 0$ then in this case $C_1 = C_2 = 0$

The general solution now becomes:

$$M^R_r = \frac{\alpha}{1+\alpha}\,M^t_r$$

$$M^G_r = M^t_r - M^R_r$$

$$= M^t_r - \frac{\alpha}{1+\alpha}\,M^t_r$$

$$= \frac{1}{1+\alpha}\,M^t_r$$

Therefore, $$\frac{M^G_r}{M^R_r} = \frac{1}{\alpha} \qquad \ldots\ldots\ldots \quad (5)$$

A complete solution now requires only that the horizontal component H be found. Since the hangers are assumed to be pin connected, it is obvious that the horizontal component H is constant. The second work equation permits the computation of H.

By placing a unit load along the center-line of the girder an $\overline{M}$ surface (Fig. 4) is obtained which combined with the M surface of Fig. 5 in equation (2) gives rise to the following equation.

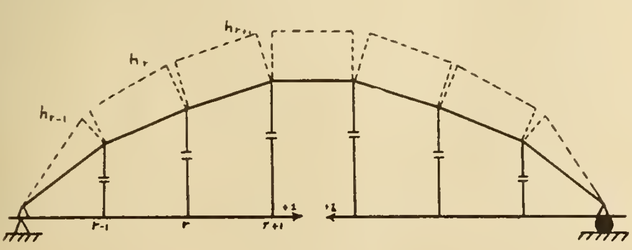

Fig. 4—$\overline{M}$ surface.

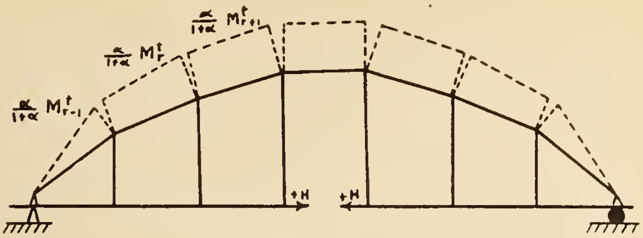

Fig. 5—M surface.

$$\delta = \sum_o^n \int_o^l \frac{\overline{M}Mdx}{EI} + \sum_o^n \int_o^l \frac{\overline{N}Ndx}{AE} = \sum_o^n \frac{HL}{A_G E}$$

By combining the M-surfaces and using equation (5) the solution for H is determined as follows:

$$\sum_o^h \frac{\alpha}{1+\alpha}\left\{\frac{h_{r-1}}{6I^R_r \cos\phi_r}\left[2(M'_{r-1} - Hh_{r-1}) + (M'_r - Hh_r)\right]\right.$$

$$\left. + \frac{h_r}{6I^R_r \cos\phi_r}\left[(M'_{r-1} - Hh_{r-1}) + 2(M'_r - Hh_r)\right]\right\}$$

$$+ \sum_o^n \frac{H}{(\cos\phi_{r-1})^3 A^R_r} = H\sum_o^n \frac{1}{A^G_r}$$

from which

$$\sum_o^n \left[(2h_{r-1} + h_r)\,M'_{r-1} + (2h_r + h_{r-1})\,M'_r\right]$$

$$= 2H\sum_o^n\left[(h_{r-1})^2 + h_{r-1}\,.\,h_r + (h_r)^2\right] - \frac{\alpha+1}{\alpha}\,H\sum_o^n \frac{6I^R_r}{(\cos\phi_r)^2 A^R_r}$$

$$+ \frac{\alpha+1}{\alpha}\,H\sum_o^n \frac{6\cos\phi_r}{A^G_r}$$

Since the last two terms are small, when compared to the first term, they can be neglected.

Therefore,

$$H = \frac{\sum_o^n\left[(2h_{r-1} + h_r)\,M'_{r-1} + (2h_r + h_{r-1})\,M_r'\right]}{2\sum_o^n\left[(h_{r-1})^2 + h_{r-1}\,.\,h_r + (h_r)^2\right]}$$

CONCLUSIONS

The solution of the following equations resolves the structure into a statically determinate case,

$$M^t_r = M'_r - H\,h_r$$

$$M^G_r = \frac{1}{1+\alpha}\,M^t_r$$

$$M^R_r = \frac{\alpha}{1+\alpha}\,M^t_r$$

$$H = \frac{\sum_o^n\left[(2h_{r-1} + h_r)\,M'_{r-1} + (2h_r + h_{r-1})\,M'_r\right]}{2\sum_o^n\left[(h_{r-1})^2 + h_{r-1}\,.\,h_r + (h_r)^2\right]}$$

All the necessary information for solving these equations may be obtained from the dimensions and loads for any particular tied arch. With the moments at the panel points as well as the horizontal tension in the girder and thrust rib known, stresses in the hangers may be computed by the ordinary methods of statics.

A comparison of results obtained by the method here described with those obtained by other methods, shows a maximum difference of but 2 per cent in the value of H. In the former case a numerical computation was used for an actual structure with a small camber in bottom chord.

RESEARCH COUNCIL RECONVERTS TO PEACE

The many and varied activities of National Research are listed and the purpose of each described. The reader is permitted a "peek through the key-hole" of each laboratory at all the interesting scientific studies and experiments. The story here unfolded of Canada's scientific future is one which no engineer can afford to miss.

The end of 1946 has seen the completion of the National Research Council's reconversion from war to peace. Just as in 1939 it was a major task to convert the existing peacetime organization into a powerful weapon for war, so too in 1946 reconversion posed even more arduous problems. Huge war research facilities had to be discontinued or modified. Most of the additional wartime staff have been absorbed into the peacetime establishment, but many younger members have left to complete their prewar academic studies. Other matured and skilled scientists with years of intensive research training on the Council staff, have joined the service of Canadian industries, thus indirectly extending the influence of the Council. The Council is now recruiting the necessary high calibre personnel to fill its peacetime establishment.

During the year, three new divisions and several new laboratory sections have been established; radar and other war equipments are being adapted to commercial use; hundreds of investigations are in progress; and the Council is actively engaged in the promotion and coordination of scientific research throughout the Dominion.

An Atomic Energy Research Division has been established at Chalk River to investigate the applications of atomic energy and the use of its products in industry and medicine. A Division of Medical Research has been organized. A Building Research Division is shortly to be set up to study construction materials and their use. Work is progressing on the building of a Prairie Regional Laboratory at Saskatoon for studying better utilization of farm surpluses, such as wheat and farm waste products. An Electrical and Radio Branch has been created. The activities of the Chemistry Division have been regrouped into two new branches: (i) Fundamental Chemistry, and (ii) Applied Chemistry. The tailless glider designed and built in the aeronautical laboratories, was test flown successfully at Edmonton. Jointly with the R.C.A.F., a Flight Research Section has been established at Arnprior. A new section of the Mechanical Engineering Division deals with problems in gas dynamics, such as gas turbines and jet propulsion.

Atomic Energy Research

In June 1946, the Dominion Parliament passed "The Atomic Energy Control Act". This Bill provides means for the development of atomic energy and for the control of work in this field as may be required in the interest of public safety and in the fulfilment of international obligations. A Board of five members was set up under the Right Honourable C. D. Howe, Hon. M.E.I.C., as Chairman of the Privy Council Committee on Scientific and Industrial Research. The President of National Research is an ex officio member of the Atomic Energy Control Board.

The engineering, construction and operation at Chalk River were carried out by Defence Industries Limited, under contract with the Department of Reconstruction and Supply. As the undertaking was really a pilot plant which must be closely integrated with the Research Laboratories, it was realized that one Government organization should assume all over-all operating responsibilities. The Atomic Energy Control Board therefore recommended that National Research be asked to undertake the integration of the various projects and their operation on its behalf. This was agreed to, and early in 1947 the Council will take over the administration and operation of the entire atomic energy development at Chalk River, in accordance with general policies fixed by the Control Board.

Information Services

In the newly established Division of Information Services, including library, liaison offices, *Canadian Journal of Research,* and technical information service, all activities relate to the collection and distribution of scientific and technical information. Of special interest are numerous reports on technical developments in Germany. Recent studies carried out in that country confirm that United Nations have not lagged behind in scientific and technical progress; in some fields, however, Germany had worked out improved methods of production. Reports on enemy science and technology are being distributed to industrial and scientific organizations in Canada. Arrangements have also been made to secure for scientific libraries copies of German scientific books and journals. On request, specially trained workers search not only German but many other reports for the solution of specific manufacturing problems.

Radio Research

The most important contribution in the development of radio aids to both air and marine navigation during the year was a radar distance indicator which enables an aircraft pilot to ascertain his distance from one or more pre-selected ground stations, thereby determining his position. The distance is read directly in miles on a simple meter and no interpretation or computation is necessary. This device has outperformed foreign devices. A more recent addition to this same unit to enable the pilot to determine his direction from pre-selected stations as well as distance, is now awaiting airborne trials.

In the marine field, most of the year's effort has been devoted to the installation of surplus radar equipment on Canadian merchant ships. The success of this programme has been most gratifying and many ships' captains have reported in glowing terms of radar performance.

Canada has long been a leader in advancing the technique of surveying. Canadian surveyors were quick to recognize the possibility of employing radar location in their work. The Council is cooperating in the development of radar equipment to determine base lines up to 300 miles long with an accuracy of 20 ft. and to permit spot fixes of photographic aircraft with an accuracy of 100 ft. in 200 miles. The laboratory is also developing an accurate radio altimeter capable of providing a continuously recorded altitude measurement, accurate within 50 ft.

In cooperation with the Canadian Radio Wave Propagation Committee, National Research Council engineers undertook the direct supervision of a study of the effects of the troposphere on radio wave propagation in the 10 cm. and 3 cm. regions. Experimental work is completed, and the data are now being analyzed. Many examples of tropospheric "skip-distance" were noted and the data should be of value in the evolution of the theory of radio wave propagation in the lower atmosphere. Along the Alaska Highway and in the Yellowknife region experimental installations of microwave radio have been made for army and R.C.A.F. The Laboratory and the Railways have established an experimental chain of radio stations between Montreal and Windsor. Communication links of this type may supplement land lines or even supplant them in some cases.

Of particular interest is a 5,000,000-volt direct current generator now under construction in the electrical engineering laboratory for the Division of Atomic Energy at Chalk River. This unit will be employed in the acceleration of both electrons and ions in nuclear research. An experimental cavity type accelerator, the principle of which springs from the development of radar equipment during the war, is also being built.

Discrimination between spurious or interfering radar pulses and desired pulses is being studied. Success here may make it possible to operate pulse systems with much closer channel spacing than has been possible heretofore.

Influence of radar on the approach to every day problems is very noticeable in the development of a fault locator for long-distance power lines. This device imposes a sharp pulse on a line and measures the time of propagation and the return of the echo from any discontinuity in the system. Open circuit, short circuit, and partial faults can be identified readily. Preliminary application of this unit has been encouraging.

Studies have been carried out on the radio disturbance created by the sun in the 10 cm. band. Very interesting results were realized on the day of the eclipse, 23 November. A systematic comparison of the "clutter" from rain and snow on both the 3 and 10 cm. bands is under way at Scarboro.

General Physics

In the field of geophysical research and prospecting, an entirely new exploit with a magnetic airborne detector (M.A.D.) has been undertaken, with the help of the United States Navy and Army authorities, in the loan of essential equipment. This new application of apparatus devised originally for detection of submarines is greatly hampered by lack of staff. Efforts will be devoted to determination from the air of the earth's magnetic elements, as well as the location of ferrous and oil mineral deposits.

Sonic and ultrasonic echo-ranging equipment has been designed to determine the depths of over-burdens in certain terrains. Also under way is an attempt to discover radio-active deposits (of uranium) by the use of Geiger counters let down into vertical drill holes.

Conversion of the 600 K. V. rectifier set for accelerating ions rather than electrons has been completed. The necessary auxiliary control and detection equipment for measurements in nuclear physics, has been built and experiments have been undertaken. Researches with this positive ion beam include studies of fission by fast neutrons and cloud chamber investigations of certain atomic disintegration.

It has become necessary to construct two more standardization sets for certification of radium. During the year some 2500 radium containers were measured and certified as to their X-ray equivalent

Certain possible uses of high-intensity, high-frequency sound are being investigated, for example its lethal effect on bacteria. Experiments were carried out on using high-frequency vibrations to improve the soldering of aluminium. In the reverberation chamber several types of acoustical materials have been tested. The anechoic, or "dead" room was completed and put to considerable use. Measurements in it have been made on loud-speakers, hearing aids and on a model aircraft engine exhaust stack.

Heat Studies

Two experimental buildings of the radiant heating project have been completed and heat turned on. Interesting results will be available in the Spring. Work on thermostatic control of heated refrigerator cars, has been resumed. By improving the heat-control mechanism better results have been obtained than ever before but the thermostat itself is still too sensitive to mechanical vibration.

A model infra-red detector to ascertain whether joints were heating on transmission lines, is being rebuilt to make it more suitable for field work. An apparatus has been completed by measuring the thermal conductivity of metals up to 800 deg. C. Results obtained correlate well with determinations made in other countries, so that it can now be used with assurance for the measurement of thermal conductivities of metals as required.

Measurements on the thermal conductivity of building materials and on moisture transmission of building papers have been carried out. An apparatus to supply moisture in homes was tested. Work is being continued on migration of moisture. Importance of this work arises from the necessity of improving our forest-fire-prediction methods and our grain-storing techniques. The cause of low friction of ice under certain conditions is being sought. Results could help solve problems of getting sleighs to slip and tires to grip.

Photographic Research

Work on night photography has been concluded and a paper describing the final techniques is in process of publication. Development of a tri-camera mount for the B-25's was completed and a paper published. In high-speed motion-picture photography research progress has been made in the design of a properly engineered model of a camera to attain 200,000 frames per second, and higher speeds are anticipated.

Studies have been made regarding dimensional stability of film under actual survey conditions, and results published. A successful densitometer has been completed. Further work has been done on the measurement of emulsion speed for aerial photography by a resolving power criterion.

The Canadian Photographic Research Committee has been replaced by an Associate Committee on Photographic Research, which has sponsored much of the photographic research done in this laboratory. Work has also been done on photometric standardization, as well as in colorimetry. A General Electric recording spectrophotometer is being installed. Some spectrochemical analysis has also been carried out, but work is hampered by shortage of staff.

Industrial Uses for Agricultural Products

Recent expansion of work on industrial utilization of agricultural wastes and surpluses includes a modern laboratory on the campus of the University of Saskatchewan. Some laboratory and pilot-plant equipment has been delivered, and a small group is actively at work in space borrowed from the University.

Meanwhile, in the Ottawa laboratories, production of new chemicals from farm crops is being studied. Pilot-plant studies on the production of *levo*-2, 3-butanediol from wheat with *Aerobacillus polymyxa* were completed. Contamination difficulties have been overcome, and fermentation efficiencies of 90-100 per cent were consistently obtained. A start has been made on fermentations using other organisms and other substrates. Several hundred strains of bacteria of the *Bacillus* group and a number of *Serratia* have been examined. The former produces glycerol as well as diol; some of the *Serratia* produce formic acid in addition to diol. Several of the more promising strains will be studied on a pilot-plant scale.

A study of the reaction between 2, 3-butanediol and phthalic anhydride led to the development of a method suitable for the commercial production of the resulting phthalate resin. Its physical properties mark it as outstanding. This new material has a low solution viscosity. It is lustrous, very hard, and almost colourless, has a wide range of solubilities in industrial solvents and is water- and light-resistant. Its flow point is much higher than that of commercial ethylene phthalate. It is now being evaluated as a non-convertible binder in paints, lacquers, and varnishes.

Because of shortages of sugars and corn syrups, wheat syrup was investigated on a semi-pilot-plant scale. The pilot plant has been redesigned and used for separating starch and gluten from wheat; first quality syrups were prepared from this starch.

Chemistry

In the Fundamental Chemistry Branch, the organic section has been engaged in research on synthetic rubber and the isolation of new alkaloids, while the work of the inorganic section has been confined to investigations for the atomic energy project.

Studies in surface chemistry have included the effect of physical adsorption on the electrical conductivity of activated carbon rods and the length changes of carbon rods caused by physical adsorption of vapours.

An investigation of the physical properties of gases at high temperatures was undertaken and apparatus built which will permit precise determination of equation of state data up to a temperature of 1500 deg. C. and a pressure of approximately 100 atmospheres.

Some of the chemical engineering staff have been on loan at Chalk River, and have been responsible for chemical process development and equipment design for the atomic energy plant. They provided water-treatment and heat-transfer data for the pile cooling system. Another major project has been the design of a new chemical engineering building at Ottawa.

Industrial Applications

The textile section has completed a number of investigations such as treatment of fabrics with dust-laying oil for hospital use; rot-proofing of textiles; thermal insulation of protective clothing, and impact testing of cordage materials. Cooperation has been continued with Government departments on wool standards, the testing of flax quality and in the drafting of textile specifications. Cooperation with industry has been continued in the adaptation of textiles to special uses, and in improving methods for laundering and cleaning textiles. Much has been done on the use of synthetic detergents, water repellents and moth-proofing agents.

An important project is the study of corrosion of steel by water. The mechanism of corrosion inhibitors and the role of the potential of metals during corrosion are being investigated. Equipment is being designed to obtain reproducible results, in testing the corrosion resistance of metals under salt spray or high humidity conditions. The corrosion resistance of welded special stainless steels before and after heat treatment is being examined.

Catalytic air oxidation of ethylene to ethylene oxide has been studied and preliminary data have been obtained on a new type of catalyst. Deuterium compounds have been prepared for use in the atomic energy project.

The protective coating section has continued an extensive research into the chemistry of long-chain unsaturated fatty acids, which are an essential constituent of drying oils in protective coatings. Another project deals with rot-proofed coatings for wood.

The rubber section has continued to advise Government and industry on natural and synthetic rubber, including special applications of synthetic rubber. A current project is the standardization of tests for ageing, resilience, abrasion resistance and tensile strength of rubber carried on in cooperation with Polymer Corporation.

In applied physical chemistry a number of wartime investigations may lead to important peacetime applications, such as: (i) a new method of propeller de-icing; (ii) control of frost on standing aircraft; (iii) an effective rain repellent for aircraft windows, now adopted by the RCAF and under test in England; (iv) a stable catalyst for the oxidation of carbon monoxide to accurately determine low concentrations in air. Atmospheric pollution by smelter smoke in the Sudbury district is being investigated, to determine concentration and distribution of sulphur dioxide from smelter smoke at different levels under varying atmospheric conditions.

In colloids and plastics, assistance has been given to the Canadian Standards Association in the drafting of a Canadian code for head and eye protection. Relation between chemical structure and plasticizer reaction is being studied. Further work has been done on the activation of contact-bleaching clays. Lubricating problems in connection with railway-car journals have been investigated. In addition, many studies in colloid chemistry have dealt with special subjects of fundamental interest. On the applied side, several projects supported by industry are in progress. Results are made available to firms concerned.

Aeronautical Engineering

The tailless glider has been a major project of the aeronautical laboratories. It is well equipped with photographically recording flight instruments. Readings during flight trials are now being studied to determine the control and stability characteristics of tailless aircraft.

Inauguration of the Flight Research Section of the aeronautical laboratories at Arnprior was another item of major importance in 1946. To date the emphasis in this work has been on building up a research staff and developing suitable flight research techniques and instruments. However, work has been initiated on airborne magnetometer apparatus for determining ore bodies from the air, airborne radar altimeters useful for topographical survey; and full-scale flying projects for the aerodynamics section, including the study of aircraft controls and stability. The facilities were used to demonstrate Australian multiple-track radar beam before PICAO officials and others.

In cooperation with the Royal Canadian Air Force and British Ministry of Supply (Air) an investgation of aircraft de-icing is proceeding using a Consolidated RY3 aircraft which has been equipped for extensive tests and for the collection of meteorological data on ice formation. Woven-wire-type heater elements have also been designed for both continuous and cyclic wing de-icing tests on aircraft.

There have been more wind-tunnel tests on new Canadian-designed aircraft than ever before. Tests on two aircraft started prior to 1946 were completed in that year; tests on two more aircraft were both started and completed in 1946, and construction of models for another aircraft is under way. In addition, wind-tunnel and spinning tunnel models have been constructed and tests are nearing completion on a new American-designed aircraft for a Canadian firm.

An intensive programme has been undertaken to train junior engineers for fundamental research in the field of gas dynamics. Extensive calculations have been made on the various types of gas turbine power plants with particular attention to the significance of turbine blade cooling by compressor air-bleed methods.

Engine Research

Work has proceeded in the engine laboratory on single cylinder engine units along the pattern set up by the C.F.R. Aviation Fuels Division. Fuels can now be rated in regard to detonation characteristics on both Perseus and Peregrine single-cylinder engines. The study of the glow-plug method of ignition is proceeding to eliminate high-tension ignition and reduce detonation. A theoretical study of an aircraft lubrication system with reference to the effects of entrained and dissolved air has shown that the altitude at which the oil system fails, depends largely upon percentages of entrained and dissolved air.

Hydraulics

In the hydraulics laboratory a model of a Great Lakes' harbour was tested to determine the effect of a proposed pier extension upon sand-bar formation in the harbour entrance. Tests are being conducted on a model of a large Canadian river to determine the effects of various types of dykes upon river currents and sand-bar formations. In each case it was possible to determine quickly and cheaply the effect of large structures.

Model tests were performed on a proposed spillway structure designed to carry flood discharge, to determine discharge capacity and to indicate possible improvements in flood conditions.

Fuels and Lubricants

Research on lubricants has yielded much valuable information on flow characteristics of greases at low temperatures. Work on oils included examination of oils and filter cartridges from high-temperature road tests and a problem in the lubrication of parachute release mechanisms at low temperature. A new supercharged knock-test engine was installed for the testing of high octane fuels. Methods for measuring detonation, and for determining octane numbers of very small fuel samples were investigated.

Testing of domestic oil-burning equipment was continued for the Canadian Standards Association. Seventy-seven appliances submitted by 45 different dealers have been under test. Listing was recommended for 42 of these, of which 80 per cent had first to be modified to meet requirements.

Structures

To demonstrate to Canadian boat builders the possibility of moulded plywood techniques for sporting craft, a 14-foot international dinghy was built. Five-ply veneer was used for the hull, and only one rib, made of laminated spruce and located just after the mast, was used. The hull was bonded to a laminated spruce keel.

Work on artificial limbs has continued making use of processes developed during research on moulded aircraft components. A latex hand, a hollow impregnated fabric hand and moulded forearm sections have been developed and several Symes' prostheses have been designed and constructed. An above-knee leg has been made from low-pressure fabric laminations. Some of the limbs produced are undergoing service tests on amputation cases.

Building Research

A Building Research Division is soon to be established. Various National Research projects have had for their object the improvement of building materials and housing construction. Intensive work was initiated some years ago on the requirements for structures, and the National Building Code was subsequently published for use as a model in the drafting of municipal building by-laws. A model zoning by-law was also prepared. Both of these publications have been extensively used as reference works by Canadian municipalities.

In the laboratories, numerous studies have been directed towards the bettering of housing conditions, such as efficiency in lighting, researches on sound-deadening, relative values of different insulating materials, measurements on vapour barriers to prevent moisture condensation, and on ventilation. Reports have been issued on heat losses through windows and moisture on windows. Tests are being made continuously on oil burners to ensure their safe operation. One of the earliest studies made was on fuel saving possibilities in house heating.

Among the newer projects is the current investigation on " panel " or radiant heating, to find satisfactory answers to questions raised by heating engineers regarding this new plan of heating whereby the source of heat is in or under the floor or in the ceiling instead of conventional type radiators. Two experimental houses have been built for study and data will be available in the spring.

A modular system for the construction of prefabricated houses has been developed. By means of prefabricated wall panels and flat roof panels incorporating structural strength, insulation, vapour barrier, finished surfaces, and a connection system, the construction of houses almost entirely in the factory under mass production methods will be feasible. The various standard wall panels, all with identical overall dimensions, permit the adoption of practically any floor plan to suit the requirements of the site and the builder. Further work on details of fabrication is in progress.

With the establishment of the proposed Building Research Division, all of this work will be brought sharply into focus and new projects will be initiated as required, to provide complete coverage of Canada's most pressing problem, the provision of adequate and efficient housing for its people.

In peace as in war, the National Research Council is ever on the alert to bring the miracles of modern science into the service of the Canadian people.

REPORT OF THE COUNCIL FOR THE YEAR 1946

Together with Committee and Branch Reports

The decrease in growth and activities that was expected to follow the cessation of war has not materialized. 1946 made new records from every point of view and has added one more step to the record of progression built up over the last ten years. This will bring a glow of satisfaction to all those persons who have so unselfishly given of their precious time to advance the affairs of the Institute.

Not only has 1946 maintained the progression but it has amplified it, as a study of this report will show. The increasing demands on the Institute are a definite indication of its usefulness to the profession and the public.

Membership

The end of 1946 saw the Institute with an overall membership of 8,407—again a record. New names added to the roster totalled 1,234 as compared to 791 for the previous year. This is the largest acquisition ever recorded. The losses from deaths, resignations and removals for non-payment of fees leave a net gain of 1,037 as compared to 653 for 1945.

A noticeable change in the statistics is the great increase in the number of Juniors. Over one thousand were transferred from Student, mostly under the automatic feature of the new by-laws. This will do much to maintain the vitality of the organization. The total of Students and Juniors is now over 3,600—thus providing a unique opportunity for service to the young engineer.

Rehabilitation

Happily, the requirements of members from the forces have been reduced greatly. The funds provided voluntarily by the membership for this service have been adequate, and sufficient remains to take care of the needs of any who may need assistance in 1947. The service to veterans now consists mostly in finding new employment, either more suited to their tastes and talents, or perhaps more remunerative.

Council Meetings

Eleven meetings of council were held during the year, four of them being away from Headquarters. The average attendance of councillors throughout the year was fourteen.

Annual Meeting

Again this meeting made new records in every department. Over 1270 were registered and almost 1,000 attended the banquet. Lack of proper hotel accommodation has become a serious problem for the Institute, particularly in Montreal, where the largest branch membership is concentrated. The work of the committee is more than ever praiseworthy in the light of these handicaps.

Maritime Professional Meeting

The Maritime Professional Meeting, which took place at Digby in early September, as a continuation of the Pictou Meeting interrupted by the war in 1939, was the first professional meeting to be held in the Maritimes since the Institute has entered cooperative agreements with the Associations of Professional Engineers of Nova Scotia and New Brunswick, and therefore was made a joint meeting. The success achieved is a good illustration of effective cooperation.

The hope has been expressed that, in future, Maritime Professional Meetings will be held every other year, alternating between Nova Scotia and New Brunswick for locale.

Committees

Without committees the Institute could not function. Over 400 members now devote considerable time to such work, and probably more committees, particularly in the technical field, will be set up in the near future. The contribution in time made by these people represents a real sacrifice. These days, every engineer has more than he can compress into his working day, attending strictly to his own professional and personal affairs—and yet these hundreds of members accept Institute responsibilities because they are in the interests of the profession. It is a genuine service of which the benefactors are not always aware.

By-Law Changes

Probably no amendments to the by-laws have been as important as those approved with impressive majorities in 1946. The full effect will not be apparent until well on in this year, but already noticeable results have been obtained. Perhaps the most significant change relates to the automatic transfer of Students to Juniors. Over a thousand were transferred by January 1st 1947, without payment of transfer fee, all of which will result in increased branch activity and increased revenue both for branches and Headquarters.

Another far-reaching amendment related to the election to life membership of all those who have paid fees as corporate members for thirty-five years, or who having reached age seventy have paid such fees for thirty years. In this way, on January 1st, 209 Members became Life Members. No longer will they be required to pay the fees of the Institute.

Other changes affected the conditions for admission, and resulted in the establishment of an Admissions Committee. The latter is now functioning nicely and already has clarified and reduced the work of Council.

New Branches

Not for many years have two new branches been established in one year, but 1946 saw charters presented to the Kootenay Branch at Trail, B.C., and to the Cornwall Branch at Cornwall, Ont. Both ceremonies were outstanding events that launched the new enterprises with a considerable show of success and publicity.

Negotiations are under way for branches in four other centres, and it may be that by the end of this year further additions to the family can be announced.

Cooperation

The history of the year contains several examples of cooperative success with sister societies. Outstanding, of course, is the Conference of Commonwealth Engineering Institutions held in London, England, in September, at which procedures and programmes were agreed upon to promote cooperation between organizations throughout the Commonwealth. The president and general secretary attended to represent the Institute.

In June, the summer meeting of the American Society of Mechanical Engineers, held in Detroit, was made a cooperative endeavour and was billed "with the Engineering Institute of Canada participating". The president and general secretary and many members from Ontario were present.

The joint committee met in New York in December and agreed upon further cooperative projects to be worked out in 1947. Already arrangements for some of these are under way.

Steps have been taken to revive the cooperative agreement between the Institute and the Royal Aeronautical Society, which was inaugurated in 1931, but which has been dormant during the war years. The proposal now is to make it a three-cornered document embracing also the Institute of the Aeronautical Sciences of the United States. Already interviews with the officers in London and New York have taken place and it is possible the agreement may become effective early in 1947. The objective is to have the members of the other two organizations resident in Canada join with members of the Engineering Institute to establish cooperative aeronautical sections in different parts of this country.

Through the year in many places there have been joint meetings between the Institute and other societies, and it has been amply proven that these combined efforts are mutually pleasant and profitable. It is hoped and expected that the practice will expand even beyond the present achievements.

Student Conference

A highlight in the year was the conference of students held in Montreal during the Annual Meeting. Representatives from every university were invited to meet with officers of the Institute's Committee on the Training and Welfare of the Young Engineer, to discuss their own problems and the part that the Institute could play in helping to solve them. The group met for three days and covered an astonishing amount of ground. The costs including transportation were met out of Institute funds.

With the 1947 meeting being called for May it will be difficult to get full attendance this year, but discussions with the universities are now under way, and it is expected some arrangement will be agreed upon that will meet the situation.

Deans Conference

Another highlight was the conference of deans held during the annual meeting. This was a preliminary session out of which has grown a formal organization that will permit the educational authorities to come together at regular periods to discuss engineering education and the modern trends.

Library

The year saw great progress made in the overhauling of the library at Headquarters. The increasing demand for books, periodicals and bibliographies has emphasized the need of "streamlining" this service. It has been difficult to accomplish, as the increased use of the facilities has required the full time of the staff during office hours, and only overtime and some additional temporary help has made possible the many changes that have been completed during the year. The work still goes on and eventually it will be possible to offer to the membership a thoroughly up-to-date and complete engineering library.

The statistics for the library as given in the report of the Library and House Committee show how much the service is used, and how essential it is to the profession. It is an expensive operation which must continue to be so if it is to meet the demands made upon it.

Educational Fund

The year end brought assurance that Council's proposal to establish an educational fund in the name of the late Harry F. Bennett was possible of attainment. Through the branches the members have contributed generously, and in some few instances the branch attainments have been startling, although it has to be admitted that results were not uniform across Canada. The objective is $25,000, and the central committee reports that the campaign will not be closed until that amount has been reached.

Already the fund is in use and loans to deserving students have been made. It is expected that further publicity will increase the demand. Great credit is due the trustees for the success of this unique proposal. Such a fund will provide special facilities for aiding the student, thereby serving the profession, as is the aim of the Institute.

Premises

The expanding membership and the increased activities have made it necessary to add to Headquarters staff. This in turn has brought about a congestion in every part of the building, which it has not been possible to alleviate to any great extent.

It becomes painfully apparent that existing premises will not continue to meet the needs of the Institute if progress is to continue. The Library and House Committee is doing some preliminary investigation work to discover how best the situation may be met.

E.C.P.D.

The Engineers' Council for Professional Development is preparing to celebrate its 15th anniversary. It is still the outstanding example of cooperation between engineering organizations. The work of its four main committees has been advanced during the year, and expanded plans for the future are being prepared. The work of accrediting engineering curricula has been resumed and the inspection of technical institute facilities has been inaugurated. This latter is an entirely new interest undertaken at the request of the institutes themselves, and because of the need to establish standards of teaching at that level.

E.C.P.D. has accepted the invitation of the Institute to hold its 1947 annual meeting in Canada—which will be the first time that event has taken place outside the United States.

President's Visits to Branches

Because of his attendance at the Commonwealth Conference in England it was not possible for the president to complete his tour of the branches before the end of the year. However, as the annual meeting will not be held until May, he will be able to finish the task in the Spring of this year. He has only the Maritime branches left. When the travelling is finished he will have attended thirty-five meetings at all of which he was the principal speaker.

The Roll of the Institute

A new record in membership has again been attained. The total for all classifications at the end of the year is 8,407. New names added to the list during the year totalled 1,234. The deaths, resignations and removals bring the figure down to a net gain of 1,037.

Elections throughout the year produced the following results. Members 240, Juniors 78, Students 894, Affiliates 3. In 1945 the total was 791. In addition, 19 reinstatements were effected and 38 life memberships were granted. Under the new by-laws, not effective until January 1st, 1947, 209 members were granted life membership. The record of transfers was as follows. From Junior to Member 60; from Student to Member 41; from Student to Junior 1,042; from Affiliate to Member 1, a total of 1,144.

The names of all those elected or transferred are published in the *Journal* every month immediately following their election.

Removals from the Roll

There have been removed for non-payment of fees and as a result of resignations 60 Members, 32 Juniors, 33 Students and 1 Affiliate—a total of 126.

Deceased Members

During the year 1946 the deaths of seventy-one members of the Institute have been reported as follows:—

Honorary Member

Duggan, George Herrick

Members

Adamson, Francis Stanley
Akin, Thomas Bernard
Anderson, James
Armstrong, Walter James
Ashcroft, Glenn B.
Bainbridge, Robert Arthur
Beman, Edwin Arthur
Bingham, Albert Raiguel
Blair, Donald
Brillon, Jacques P.
Burns, C. H. McL.
Calvin, Reginald March
Cameron, John
Cochrane, John Bray
Copp, Walter Percy
Cook, William Henry
Cunningham, A. Irwin
DeWolfe, William Joseph
Dingman, Charles Willard
Duclos, Lewis Murray
Ewart, Cecil
Fairhurst, Thurstan William
Forde, John Preston
Fraser, William Stanley
Goodchild, Ralph Henry
Grahame, Dallas Forrest
Gransaull, Louis Raymond
Griffin, Augustus
Griffith, John Edgar
Hancox, Frederick James
Harrison, Noel Faure
Harvey, Charles
Heuperman, Frederick Justinus
Hinchliffe, Joseph Edward
Hull, George B.
Hunt, Walter George
Joron, Rodolphe Emile
Kennedy, Henry Cron
Ker, Newton James
Kirby, Charles Conyers
Lambart, Howard Frederick J.
Leebosh, Ilja
Luscombe, Charles
McCormick, R. S.
McIntyre, Vernard Howard
McLeod, Simon Fraser
Morris, James Lewis
Morrison, David
Moss, Charles S.
Motley, Phillips Bathurst
Mudge, Reginald
Richardson, Bertram P.
Roberts, Arthur R.
Roberts, John Randall
Ross, John W. LeB.
Ross, William Hope
Rothwell, James Moscrip
Routledge, George Graham
Rutledge, Lewis Traver
Stuart, Harold Brownlee
Tennant, David Cowan
Thomson, Alexander
Tremblay, Althéod
Walkem, George Alexander
Weatherbe, Karl
Willett, Norman E.

JUNIORS

Rombough, Joseph Harold Melville
Sutherland, Eric Sinclair

STUDENT

Ross, James Finlay

AFFILIATE

Mold, Robert Charles

TOTAL MEMBERSHIP

The membership of the Institute as at December 31st, 1946, totals 8,407. The corresponding number in 1945 was 7,370.

	1945	1946
Honorary Members	17	16
Members	4453	4681
Juniors	803	1833
Students	2003	1783
Affiliates	94	94
	7370	8407

Respectfully submitted on behalf of the Council.

J. B. HAYES, M.E.I.C., *President*.
L. AUSTIN WRIGHT, M.E.I.C., *General Secretary*.

LEGISLATION COMMITTEE

There has been no necessity for the committee to meet during the past year and we have no business to report.

The case of the Architects Association vs. Brian R. Perry in Montreal, is slowly progressing. The appeal of Mr. Perry against the decisions of the Superior Court has been allowed to be heard by the Court of King's Bench. It was to have been heard at the September session but has been delayed till the January session.

P. E. POITRAS, M.E.I.C., *Chairman*.

EMPLOYMENT AND REHABILITATION SERVICE

As the great bulk of the work of the Rehabilitation Committee was complete by the end of 1945, this committee has been disbanded during the course of the year and the duties carried out by the permanent staff at Headquarters. For most of the year this has involved overtime work. A report on the procedure now in force appeared in the October issue of the *Journal*. The main difficulty encountered is to find out from both prospective employers and prospective employees just what is happening. A system of follow-up letters has been instituted, with automatic closing out of files when no replies are received.

The following statistics may be of interest:—

Number of interviews during 1946	837
Number of known placements during 1946	198
Number of job files open 1st January 1946	54
New job files opened during 1946	518
Number of job files open 31st December 1946	157
Number of men's files open 31st December 1946	45

There are two major problems for the future. The first is the problem of locating openings. It is felt that members can help their fellow-members greatly by bringing the employment service to the attention of all local employers who may require engineers. While at present there are many more openings than there are engineers available to fill them, it is doubtful if this will continue. Hence it is necessary to make all possible connections with prospective employers. The majority of men now looking for employment are already employed.

The second problem arises more or less directly out of the first, having regard to the thousands of students, of whom over half are veterans, who will be graduating in the next few years. If we are not to have many dissatisfied young men unable to obtain their chosen employment, plans for their absorption must be set up now. Because of the geography of Canada this cannot be done by Headquarters alone. This is the real rehabilitation problem and one of the most serious tasks for 1947. There is no doubt that Headquarters can be of great assistance and that the Institute, through its many branches, can be a real factor in solving the problem.

A. J. KERRY, M.E.I.C., *Employment Officer*.

BOARD OF EXAMINERS AND EDUCATION

The board of examiners has been completely inactive since its recommendation that the examinations of the Provincial Associations be accepted by the Institute was adopted by Council. It, therefore, has no formal report to make.

Respectfully submitted,

R. DEL. FRENCH, M.E.I.C., *Chairman*.

PUBLICATION COMMITTEE

For the third year, the contents of the *Journal* has been governed by the paper supply. At the end of last year your committee expected that it would be possible during 1946 to increase the editorial content of the *Journal* and restore certain features which had been dropped due to the paper shortage. However, instead of improving, the situation is worse than it was at the corresponding time last year. As a result of this shortage and because of the increase in circulation, it has been found necessary to curtail the number of technical papers and also to reduce the size of type used in the Branch News and Personals sections. It would appear, at present, that the shortage will continue for some months in 1947.

In the November issue, a list of the members of the Institute was published. This list was long overdue and your Committee urges that, if it is at all possible, a membership list should be published at least every two years.

During the year, the printers have requested a further increase in their contract price. The possible extent of an increase is still under negotiation, but it will undoubtedly materially affect the future cost of publication.

Your committee has carefully considered, in conjuction with our advertising agents, our present advertising rates. It was agreed that in view of the increase in circulation and the increased cost of publication, the rates should be increased, to be effective during 1947.

Your committee has considered a number of suggestions for the improvement of the *Journal*. A re-arrangement of the editorial pages has been put into effect and, we believe, will make the *Journal* more acceptable to its readers. Early in 1947 a new cover design will be introduced which, while retaining the established characteristics of the present *Journal*, will improve its appearance. Additional editorial assistance is still an essential and it is hoped that Council will be successful in finding such assistance early in 1947. This will permit of the introduction of a number of new features in the *Journal* which have already been considered and approved by this committee.

Respectfully submitted,

R. S. EADIE, *Chairman*.

MEMBERSHIP COMMITTEE

The changes in by-laws with regard to the transfer of members, recommended by your preceding Membership Committee, were approved by the membership with tremendous majorities in the ballot taken last spring. The present committee is observing the functioning of the new procedure, and, so far, it has been working out very satisfactorily.

The committee has considered some of the probable requirements of the Branch Membership Committees as a result of the large growth of the Institute in the last few years and is submitting a brief to Council on the subject. As yet, the submission is tentative and there is enough time to permit a more complete study of the matter, so there is nothing concrete to report at the present.

The committee would welcome suggestions from the membership as to how they can best serve.

Respectfully submitted,

H. R. SILLS, M.E.I.C., *Chairman*

COMMITTEE ON INDUSTRIAL RELATIONS

Since the last annual meeting, the Committee on Industrial Relations has held three meetings—on 15th April, 17th May and 15th November. A further meeting is scheduled for the month of January.

The committee had the pleasure, at its meeting of 15th April, of a discussion with Mr. A. P. Young, O.B.E., regarding broad trends in industrial relations as exemplified in Great Britain.

The committee also heard, at its meeting of 17th May, an account of the procedures adopted by Messrs. Lever Brothers Limited in introducing the 40-hour week in their Toronto plant without loss of production, presented by Mr. J. P. Brierley.

At its meeting of 15th November, the Committee heard an account of the newly-established Institute of Industrial Relations of the University of Toronto from its head, Professor V. W. Bladen, and discussed possible cooperation with that Institute in making its purposes and facilities known to engineers.

The committee is proposing further study on the following subjects:

(i) Psychological and other techniques for the selection of employees.
(ii) Provision of employee services in industry.
(iii) Technical factors affecting the employment of women in industry.
(iv) The place of the industrial relations department in a business organization.
(v) The function of the industrial relations consultant.
(vi) Factors affecting employee morale.
(vii) Questions of supply of common labour and other subjects of interest to civil engineers in construction.
(viii) Programmes for the absorption of engineering graduates in industry.

Respectfully submitted,

WILLS MACLACHLAN, M.E.I.C., *Chairman.*

COMMITTEE ON PRAIRIE WATER PROBLEMS

While this committee did not hold any meetings during the past year, the members of the committee individually seized every opportunity to continue to advocate the construction of the works for the St. Mary and Milk Rivers Development in Alberta.

Early this year, the Canadian Pacific Railway Company transferred the irrigation works operated by it near Lethbridge to the Alberta Government. This is the key to the St. Mary and Milk Rivers Development and the transfer is a step recommended by the Meek Committee and will make it easier for the Federal and Alberta governments to get together for the early development of the larger project. Negotiations for an agreement to outline the plan of development have been started and it is felt that an agreement will be consummated at an early date. In the meantime, construction has been started on the dams for the reservoirs on Pothole Coulee near Magrath and on the St. Mary River near Spring Coulee and the canal connecting Pothole Coulee reservoir with the old main canal.

The Lethbridge Board of Trade staged an irrigation celebration on October 18th to celebrate the Silver Jubilee of the Lethbridge Northern Irrigation District and to salute the new St. Mary and Milk Rivers Development. The jubilee attracted a large number of people, many of whom came from places a long distance from Lethbridge. Seven members of this committee attended the celebration.

With a dearth of arable land the world over, the next decade should see great activity in irrigation. Plans for the Bow River and the North Saskatchewan River developments are being studied by members of the committee but the committee as a whole has not decided on a policy for these. When sufficient data is available, the committee may be asked to recommend a policy and program for the development of these projects. At any rate it is believed that the committee should continue for the time being as a standing committee that can be called up when circumstances warrant.

Your committee recommends that, if the 1948 Annual Meeting of the Engineering Institute is held at Banff, consideration should be given to the presentation of a symposium of papers dealing with water conservation and irrigation and to arranging visits to the various irrigation projects in the vicinity.

We regret to have to report that a very valuable member of this committee, Mr. A. Griffin, of Calgary, died on October 13th.

Respectfully submitted,

G. A. GAHERTY, M.E.I.C., *Chairman.*

COMMITTEE ON COMMUNITY PLANNING

The work of this Committee for the past year has been principally that of organization.

The following members have consented to act on the committee:

C. A. Meadows, Toronto; Allan K. Hay, Ottawa; Hew M. Scott, Toronto; A. E. K. Bunnell, Toronto, Aimé Cousineau, Montreal; J. S. Galbraith, York Mills, Ont.; R. L. Dobbin, Peterborough.

The Committee held a meeting in Peterborough on Monday, August 19th, at which nearly all the members were present.

A general discussion on the aims and objects of the committee took place, and among other things, it was decided to take steps to encourage the branches of the Institute to hold meetings dealing with community planning.

It was also decided that an acceptable definition of community planning would be set up by the Committee, and that the interest of the members of the Institute should be encouraged.

The committee recommended with emphasis that, due to the present day importance of community planning, a substantial portion of the time of the annual meeting should be devoted to that subject.

The committee also has taken part in the organization of the newly established Community Planning Association of Canada.

Delegates from the E.I.C. have attended meetings of this Association in Ottawa on three occasions, and the Institute is represented on the provisional board of the Association by Messrs. Dobbin, Wright and MacRostie.

Respectfully submitted,

ROSS L. DOBBIN, M.E.I.C., *Chairman.*

PAPERS COMMITTEE

At the beginning of the year the Papers Committee continued its interest in the Mulberry exhibit which was then in the western cities. Unfortunately those supporting and those immediately directing this programme decided to cut it short, and discontinued the schedule after the showing at Victoria. It was greatly regretted by those interested in this project that the eastern branches did not have an opportunity of seeing this very important and instructive exhibit.

The branches have all enjoyed a very desirable programme of papers and discussions without very much assistance from the Papers Committee. They are to be congratulated in this respect.

An effort was made to study how branches might be of assistance to each other in the furnishing of speakers, but only a limited degree of success has been experienced. However, some worthwhile suggestions have been put forth and these will be passed on for the assistance of future Papers Committees.

C. E. SISSON, M.E.I.C., *Chairman.*

CANADIAN STANDARDS ASSOCIATION

One of the principal accomplishments of the Canadian Standards Association during the current year has been the decision to set up a Welding Bureau for the purpose of qualifying plants and operators that are concerned with the application of electric arc welding to steel parts. A need has been expressed throughout industry for such a bureau and, during the year, many of the preliminary decisions have been taken and the machinery established for its operation. It is expected that, early in January, the new Bureau will be actively engaged in its first line of activity—inspection of fabricating shops, both structural and mechanical, where important welding is being carried out, with the idea of preparing records and lists of qualified firms and welders, with details as to their equipment and experience. It is generally felt that the field for welded construction can be broadened to general advantage once a proper control is established, and in response to the suggestion of interested industrial concerns, the C.S.A. appointed a provisional committee, which in turn has suggested a Provisional Administrative Board, who will, in the near future, deal with all matters of policy. It is the general opinion of those closely associated with this Bureau that it will ultimately be involved in work of a much wider scope, some of it definitely educative, and every effort is therefore being made to throughly prepare the ground and set up a competent and trustworthy organization.

During the year also, much work has been done in the electrical division both in respect to the work of continued revision of specifications, the removal of wartime concessions, and the extension of the "Approvals" work. The Approvals Board reports a very definite advance in the amount of work covered, with a corresponding increase in the staff required and in the scale of finance.

Developments in the newer fields, such as textiles and paint have been slow and, in some respects, disappointing. Nevertheless it is thought to be only proper that these matters should grow as the needs indicate and should not be pushed beyond the degree to which industry and the consumer interests require.

Much interest has been shown in the international and Commonwealth field of standardization and the director was sent to London to attend important meetings in both these connections.

The Executive Committee of the Association upon which your representative sits, has had an unusually busy year with all these new and active developments and it is the general belief that the C.S.A. has a very important part to play in the future industrial growth of Canada, particularly in the export field.

Several engineering specifications are due for revision to a lesser or greater degree, and the new year should see much activity in this branch of the Association's work.

Respectfully submitted,

P. L. Pratley, m.e.i.c., *Institute Representative.*

FINANCE COMMITTEE

During 1946 there was an increase in revenues due to expansion in membership and the appropriate application thereto of the higher annual fees approved during the year, to a correspondingly larger number of subscriptions to the *Journal*, and to a greater return from advertising in the *Journal* arising principally out of increased advertising rates made effective as existing contracts expired during the year.

There was also an increase in expenditures due to necessary alterations in the Ladies Rest Room in the headquarters building, to the larger number of Journals printed and distributed, to the Student Conference held in Montreal at the time of the Annual Meeting of the Institute, to a Professional Meeting, the first since 1939, held in Digby, N.S., in September, to a Commonwealth Engineering Conference held in London, England, in September, to increased rebates to branches, and generally to a continuous rise in the cost and volume of all materials and supplies.

The increase in revenues was more than adequate to offset the increase in expenditures, but total revenues were inadequate to defray total expenditures. The result for the year is a deficit approximately one half that of 1945.

Further increase in expenditures is expected during 1947 due to further increases in the cost of the Journal, notice of which has already been received from the printers, to the implementation as rapidly as conditions permit of the undertakings contemplated under the increase in annual fees, some of which have already been advertised in the *Journal*, to increased rebates to branches, and to the general rise in costs which is still continuing. This should be more than offset by the additional revenues from a further increase in Journal advertising rates which will become effective upon the expiration of existing contracts, and from the higher annual membership fees which became generally applicable on January 1, 1947.

The Institute has come through a year of increasing activities and costs without serious detriment to its financial position, and the prospects for the coming year are good. Unless subjected to an inflationary explosion not now in sight, the Institute should be able, during 1947, to improve its financial position.

J. E. Armstrong, m.e.i.c., *Chairman.*

COMPARATIVE STATEMENT OF REVENUE AND EXPENDITURE

For the year ended 31st December, 1946

Revenue

	1946	1945
Membership Fees:		
Arrears	$ 3,774.76	$ 3,934.24
Current	42,144.92	36,064.87
Advance	1,730.87	1,279.40
Entrance	2,504.58	2,951.28
	$ 50,155.13	$ 44,229.79
Publications:		
Journal Subscriptions	$ 13,531.62	$ 10,841.05
Journal Sales	19.50	71.93
Journal Advertising	39,199.57	29,229.30
	$ 52,750.69	$ 40,142.28
Income from Investments	$ 1,027.17	$ 1,188.87
Refund of Hall Expense	550.00	450.00
Sundry Revenue and Profit on Sale of Securities	132.16	899.16
Total Revenue for Year	$104,615.15	$ 86,910.10

Expenditure

	1946	1945
Building Expense:		
Property and Water Taxes	$ 1,278.43	$ 1,496.83
Fuel	804.59	533.91
Insurance	151.65	173.91
Light, Gas and Power	515.51	460.39
Caretaker's Wages and Services	1,229.80	1,231.50
House Expense and Repairs	2,624.20	1,249.86
	$ 6,604.18	$ 5,146.40
Publications:		
Journal Salaries and Expense	$ 42,335.76	$ 37,159.63
Sundry Printing	725.00	1,055.33
	$ 43,060.76	$ 38,214.96
Office Expense:		
Salaries	$ 23,091.34	$ 21,375.02
Telegrams, Postage and Excise Stamps	2,874.00	2,270.94
Telephones	860.03	852.00
Office Supplies and Stationery	4,501.18	3,310.64
Audit and Legal Fees	300.00	378.24
Messenger and Express	98.29	235.67
Miscellaneous Expense	1,046.01	442.26
Depreciation—Furniture and Fixtures	433.00	401.67
	$ 33,203.85	$ 29,266.44
General Expense:		
Commonwealth Conference	$ 1,058.00	—
Students' Conference	1,180.25	—
Annual and Professional Meetings	2,098.05	$ 1,763.09
Meetings of Council	1,851.21	814.27
Travelling	2,421.13	1,842.27
Branch Stationery	146.35	102.56
Institute Prizes	493.28	356.24
Library Salary and Expense	2,692.39	2,474.43
Interest, Discount and Exchange	83.36	35.34
Committee Expenses	750.04	639.08
Cost of Membership in other Organizations	853.57	1,271.28
Sundry Expense	666.71	498.97
	$ 14,294.34	$ 9,797.53
Rebates to Branches	$ 9,227.53	$ 7,895.87
Total Expenditure	$106,390.66	$ 90,321.20
Surplus or *Deficit* for Year	*1,775.51*	*3,411.10*
	$104,615.15	$ 86,910.10

TREASURER'S REPORT

The audited statements of assets and liabilities and of revenue and expenditure for the year ended December 31st, 1945, are herewith submitted. The accounts for the year show a deficit of $1,775.41.

The securities as shown in the auditor's statement have been checked and found in order. The market value of these at today's date is approximately $52,250.00 as against $48,895.97, the cost to the Institute.

The revenue from membership fees shows an increase of $5,725.34 or 13.4% over the previous year; that of publications shows an increase of $12,608.41 or 31.4% over the previous year.

Expenditure exclusive of that chargeable to publications, shows an increase of 21.5% over 1945; that in respect of publications only, shows an increase of 12.7% over 1945.

It is interesting to note that the net profit from publications is $9,689.63; a decided improvement over the previous year's figure of $1,927.32.

A general study of the statements herewith submitted and various statements since 1936 will prove decidedly the wisdom of the increased fees which have been voted so generously by the membership. Notwithstanding the higher receipt from fees, no effort should be spared to increase substantially our net profit from publications.

The Institute and its branches with the increase in revenue to be expected from the increase in fees and increased membership will now be in a position to face their greater opportunities and responsibilities. We hope that the increase in revenue for 1947 will permit not only a substantial addition to the building fund, but also a substantial increase in our surplus fund, which should be brought back to at least the figure of 1944.

J. A. Lalonde, M.E.I.C., *Chairman.*

Rehabilitation Fund

Balance as at 31st December, 1945		$ 2,641.73
Receipts, 1946		7,526.68
		$ 10,168.41
Expenditures:		
Salaries	$ 6,303.96	
Travel	40.30	
Printing, etc.	652.48	
		6,996.74
Balance as at 31st December, 1946		$ 3,171.67

COMPARATIVE STATEMENT OF ASSETS AND LIABILITIES

As at 31st December, 1946

Assets

Current:	1946	1945
Cash on hand and in Savings Account	$ 2,657.10	$ 2,357.71
Accounts Receivable—less Reserve	7,448.45	6,959.53
Arrears of Fees—estimated	2,500.00	2,500.00
	$ 12,605.55	$ 11,817.24
Investments at Cost	48,895.87	48,992.37
(Market value as at 31st December, 1946—Estimated, $52,250.00)		
Sundry Advances	250.00	250.00
Deposit with Postmaster	175.00	100.00
Prepaid Insurance	60.00	150.00
Gold Medal	45.00	45.00
Library—At cost less Depreciation	1,448.13	1,448.13
Furniture and Fixtures—At cost less Depreciation	3,896.98	3,615.10
Land and Buildings—Assessed Valuation	36,000.00	36,000.00
	$103,376.53	$102,417.84

Liabilities

Current:		1946	1945
Bank Overdraft—Current Account		$ 4,094.27	$ 1,524.69
Accounts Payable		8,524.94	9,750.36
Rebates to Branches		400.00	499.98
Unexpended Balance of Rehabilitation Fund		3,171.67	2,641.73
		$ 16,190.88	$ 14,416.76
Special Funds		16,575.58	15,615.50
Reserves:			
Building Fund		5,000.00	5,000.00
Building Maintenance		2,000.00	2,000.00
Contingent Reserve		5,000.00	5,000.00
Surplus Account:			
Balance as at 31st December, 1945	$ 60,385.58		
Less: Excess of Expenditure over Revenue for year as per Statement attached	1,775.51		
		58,610.07	60,385.58
		$103,376.53	$102,417.84

Audit Certificate

We have audited the books and vouchers of The Engineering Institute of Canada for the year ended 31st December, 1946, and have received all the information we required. We have verified the Cash in Banks and the Investment Securities and the revenue therefrom. In our opinion, the Statement of Assets and Liabilities and Statement of Revenue and Expenditure for 1946, as attached, are properly drawn up so as to exhibit a true and correct view of the Institute's affairs as at 31st December, 1946, and of its operations for the year ended that date, according to the best of our information and the explanations given to us and as shown by the books.

(Sgd.) RITCHIE, BROWN & CO.,
Chartered Accountants.

Montreal, 1st February, 1947.

LIBRARY AND HOUSE COMMITTEE

Two well-attended meetings of your committee were held and several inspections of the headquarters premises were made. Necessary repairs to roof and skylight were recommended and carried out. The committee recommended the repair of the boundary fence on the south side of the property. Before this could be done it was necessary to determine the proper location of the lot boundary and to this end a survey of the lot was recommended. This survey was made and a plan of the property was delivered, with a suggestion that the owners of the neighboring property be notified that an iron-clad building was encroaching on the Institute property. This letter was sent to the owners.

The committee discussed at length the present inadequacy of the headquarters premises and the need for still more accommodation when the contemplated additional services are installed.

It is felt that no additions or alterations to present premises would be advisable. The committee is now making a study of the replacement of the older parts of the headquarters building to form a new unit covering the whole property. The general secretary was asked to provide a statement of present and future needs with regard to space so that a preliminary plan can be worked out. It is hoped that this preliminary study will be completed before the present committee turns over its duties to its successors.

Library

The Library consists of approximately 12,850 volumes including text books, reference books, periodicals, transactions, etc., some 2,475 ft. of shelving, and 47 file drawers of pamphlets.

Accessions	1946	1945
New Books	101	60
Proceedings & Transactions	33	23
Reports & Bulletins	541	353
Standards & Tentative Standards	91	not recorded
Pamphlets	155	170

Text books to the value of $1,000 have been added to the Library in the last three years. Periodicals and serials are received on a subscription and exchange basis. Many periodicals are bound and filed permanently in the Library, others, not as frequently used, but nevertheless equally important are also filed permanently. For reference purposes, the Library has a complete set of The Engineering Index from 1892, and subscribes to The Industrial Arts Index (monthly) and other bibliographical services.

We wish to thank publishers and reviewers for their very kind co-operation during the past year. Due to paper shortage, we were able to publish only six signed book reviews in 1946, as against four in 1945, however, in 1947 we hope to publish at least one signed review a month. The Library prepared 43 book notes this year, being 11 more than in 1945. By publishing reviews and notes of new books in the *Journal*, we bring new publications to the attention of readers, and also acquire considerable new material for the Library, thus serving a two-fold purpose.

Use of the Library has increased by over 1,000 requests since 1945, as shown by the following statistics:

	1946	1945
Days Open	267½	276½
Inquiries Received		
By Phone	2,037	1,616
In Person	1,056	661
By Letter	998	723
Total	4,091	3,000
Circulation		
Books borrowed	620	542
Periodicals borrowed	1,348	938
Pamphlets borrowed	636	not recorded
Inter-Library Loans borrowed	33	20
Total	2,637	1,500
Registered Library Borrowers	329	not recorded
Special Services		
Bibliographies Prepared	102	54
Pages	229	117
Photostat Orders	18	34
Prints	442	314
Book Orders for Members	150	not recorded

The work of reorganization of the Library is progressing slowly. The stacks have been completely rearranged, and a preliminary listing of the material has been completed.

In 1947 we hope to complete all serials records and to prepare a list of Library holdings, other than text books. The weeding of the collection of obsolete material must be undertaken in the near future as lack of shelving space, file drawers, etc., is becoming a very serious handicap. However, at the present rate of demand on the Library services, little if any reorganization will be possible without further additions to the staff.

We wish to draw the following facts to the attention of members:

1. Any member may borrow material from the library. Out of town members are asked to pay all carrying charges.
2. A deposit of $5.00 must be made before material may be borrowed. This is a safe-guard against loss or non-return of material, and is refundable on receipt, in the library, of borrowed items.
3. Material may be borrowed for a period of two weeks, and renewed, at the discretion of the Librarian, for a further two week period.
4. Books, photostats, etc., may be ordered through the Library.
5. Subject bibliographies will be compiled at cost.
6. For the convenience of members, the Reference Library will be open each Thursday evening on which a Montreal Branch Meeting is being held at Headquarters.

The Library is for the use of the membership. Inquiries and suggestions are welcomed.

Your committee wishes to commend the staff for their diligent application to the work of the Institute under conditions rendered more difficult by reason of lack of adequate working space.

Respectfully submitted,

R. C. Flitton, m.e.i.c., *Chairman.*

NOMINATING COMMITTEE

Chairman: Stewart Young

Branch:	*Representative*
Border Cities	T. H. Jenkins
Calgary	P. F. Peele
Cape Breton	J. H. Fraser
Cornwall	W. P. Nesbitt
Edmonton	C. W. Carry
Halifax	A. E. Flynn
Hamilton	Alex. Love
Kingston	D. S. Ellis
Kootenay	Ernest Mason
Lakehead	W. L. Bird
Lethbridge	G. S. Brown
London	J. H. Johnson
Moncton	A. R. Bennett
Montreal	J. J. H. Miller
Niagara Peninsula	C. G. Cline
Ottawa	E. G. Cameron
Peterborough	W. T. Fanjoy
Quebec	J. O. Martineau
Saguenay	W. F. Campbell
St. Maurice Valley	A. S. Holder
Saint John	K. V. Cox
Sarnia	J. W. MacDonald
Saskatchewan	A. P. Linton
Sault Ste. Marie	R. A. Campbell
Toronto	A. E. Berry
Vancouver	A. Peebles
Victoria	J. C. MacDonald
Winnipeg	C. P. Haltalin

THE ENGINEER IN THE CIVIL SERVICE

In preparing an annual statement the committee's greatest desire would be to report that its objectives had been accomplished—that professional workers in the civil service were now paid adequately. Unfortunately this cannot be done. Some progress has been made but upon examination the results seem to be more apparent than real.

The reclassification spoken of in last year's report has been carried out in many departments, but it appears as if the authority for this change is too restricted. Another directive permits the Commission to adjust salaries when there are cases of "gross injustice". Under this heading several salaries have been increased, but in too many instances the increase has been only $60.00 per year. Just how a "gross injustice" could be remedied by the addition of such a small increase is not apparent to everyone.

The reclassification has not been done with a generous hand. but on the whole it does provide some such needed amelioration. The Professional Institute of the Civil Service in its Journal for January reports that "the progress made under this partially corrective arrangement has improved morale and introduced a new hope for the future."

Royal Commission

In April your committee appeared before the Royal Commission on Administrative Classifications in the Civil Service, and presented a constructive brief as evidence of the need of salary increases. In the report of the Royal Commission there is no evidence that the Institute's presentation had produced any effect. As a matter of fact there appeared to be nothing in the report to indicate that any presentation had produced any effect. The report was far from satisfactory to many people and up to the end of the year, with the exception of increased salaries for deputy ministers, there appear to have been no results from their deliberations.

Conclusion

Your committee does not seek any credit for what has been accomplished. Today so many agencies are interesting themselves in this problem that it will be difficult if not impossible, and certainly improper for any one to claim that it has done the trick. The kudos is of no importance as long as the results are obtained. Your committee will continue the interest that the Institute has shown in the professional worker over the last fifty years, and will be happy if it is able to make even some modest contribution towards a successful outcome.

N. B. MacRostie, m.e.i.c., *Chairman.*

COMMITTEE ON THE TRAINING AND WELFARE OF THE YOUNG ENGINEER

During 1946, the activities of this committee were directed towards finding out from the branches and from young engineers just what the Institute could do to help the new-comer in the profession. Certain proposals were submitted and each branch was asked to nominate a young engineer from whom the committee could get first-hand opinions of what is wanted.

Sixteen branches replied, ten of them appointing a young engineer as requested, five of whom have written to the chairman. This is a discouraging response, but on the other hand the five wrote such constructive letters that something has been accomplished.

The following suggestions have been made, and are now submitted to Council and to the membership of the Institute, with the hope that they will be implemented. It is realized that each branch has its own problems, and that what is suitable for one may not be for another.

1. Getting Acquainted With the Young Engineer, Especially the New-comer.

From Young Engineers

(a) Branch secretaries should invite new-comers to their first meeting, by telephone or other personal message, and make sure that they are introduced to the older members.

(b) "I see no reason why a more active social life between engineers would not be most enjoyable. To the Junior it would be a means to help widen his circle of friends in the engineering world. In the case of a young married engineer coming to a strange city, I'm sure some initiative on the part of the engineering members to make him and his wife acquainted would be very welcome".

(c) Lapel buttons should be worn at meetings. A branch membership list would be very valuable.

(d) "Experience indicates that acquaintanceship is not developed by chance, but requires a definite program. It is suggested that at each meeting someone should introduce four or five junior members and four or five seniors, giving place of birth, university, year of graduation, and nature of present work. When dinner meetings are held the introductions should be made before the meal is served, and those already acquainted should be seated away from each other".

(e) "An occasional ladies' night to give the wives of all engineers an opportunity to become acquainted".

(f) (From a member of the committee.) "When a young engineer arrives in a city in which there is a branch, a senior engineer should personally invite and conduct him to his first meeting, and there introduce him to some of the members of all ages.

From Branches

(g) "Some of our Executive stated that they were never contacted (while at a university) or issued any invitations to attend meetings, or to join the Institute and when they did attend no attention was paid to them and they were not offered welcome or encouragement".

(h) "The Engineers' Wives Association has proved very successful in welcoming and befriending newcomers".

(i) "It was the unanimous opinion of those present (at an executive meeting) that something should be done to make the young engineer feel more at home".

(j) "Social contacts could be developed most easily as a result of introductions of the new members at branch meetings".

(k) "It was decided by the executive that the reception committee should be especially instructed to seek out new members and young engineers, and to make them welcome at meetings".

(l) "All our young engineers are invited to all social functions".

2. Proposal to Sponsor a Young Engineer by a Senior

From Young Engineers

(a) Rather opposed.

(b) "A step in the right direction".

(c) "The general opinion of the younger engineers here is that they are very much in favour of it. We feel that such a 'guide, philosopher and friend' would be very much appreciated in the last few months of an engineer's graduating year. If at that time the prospective young engineer had such a person appointed as a personal advisor to him, someone with whom he could talk periodically during the last few months prior to graduation, a great deal of worry and uncertainty could be eliminated".

(d) "I believe this plan could be of inestimable value to the graduate in seeking his first year or two of employment".

(e) "If the majority of senior engineers in the branch prove to be sufficiently interested in the welfare of the junior engineers to really become acquainted, the junior will know whom he may approach for help and advice".

From Branches

(f) "An individual adviser for each young engineer is not the best solution of the problem. The creation of a friendlier atmosphere at meetings would offer spontaneous opportunities for any needed guidance".

(g) "The idea of having a particular member to advise a particular young engineer is to be discouraged. However we should like to submit an alternative suggestion . . . (a) that the various branches canvass their membership to determine those members who are willing to act as advisers to any young engineers who may request assistance; and (b) that the names and addresses of these members, their academic qualifications and their professional positions be published periodically in a list in the *Engineering Journal,* under some such heading as 'Members willing to discuss problems with junior engineers who seek assistance'".

3. Employment

From Young Engineers

(a) That a local employment service be opened by his branch because the Institute employment service is too far away, and not in touch with the local situation.

(b) That a promotional programme should be undertaken with the object of making more engineering positions: that is, municipal bodies and firms not now employing engineers should be urged to do so, the advantages of so doing being made clear to them by the Institute.

4. Training

From Young Engineers

(a) "I feel the branches should attempt to organize classes in public speaking".

(b) "A factor often overlooked is that the junior engineer cannot possibly feel himself part of the organization unless he plays a part in it. Two or three meetings during the year should be organized and carried out by the junior engineers". (Presumably this is for branches where no junior section exists).

(c) One branch has arranged for junior engineers to be taken on tours through large industrial plants in the vicinity.

From the foregoing opinions, gathered from many parts of Canada, two major conclusions are justified: first that there should be a planned and concerted effort to make young engineers feel at home in the branches, both professionally and socially, and that it is not enough to simply send a notice of meeting. Secondly, that while there is no desire to have an assigned sponsor for each junior, there is a feeling that from time to time the helpful advice of an older man would be very welcome.

It seems to the chairman of this committee that these two points constitute a challenge to the older engineers to interest themselves directly in their younger professional brethren.

Other work of the committee—Counselling for high school students has been carried on jointly with the C.I.M.M. and the C.I.C. The Montreal Branch in particular has sent a very full report of its work in this line.

Following a meeting of the committee held at the time of the Annual General Meeting of the Institute, letters were sent to the deputy ministers of education in all provinces calling their attention to the very large enrolment of students in science faculties in Canadian universities.

The chairman wishes to thank especially the Halifax, Montreal, Border Cities, Sarnia and Edmonton branches for the very thorough way in which they considered the proposals of this committee.

In conclusion one more paragraph from a young engineer's letter is quoted: "In our opinion the junior engineers would welcome the hand of fellowship on the part of the senior members. We must, here, stress however, that the onus rests largely if not entirely on the senior engineers, and unless the majority of them are really interested in the welfare of their junior fellows, the objective will not be reached. The question is not so much what *can* the members do for their younger brethren as what *will* they do".

Respectfully submitted,

L. F. Grant, m.e.i.c., *Chairman.*

CANADIAN CHAMBER OF COMMERCE

Some years ago, the role of the Chambers of Commerce and of the Boards of Trade in Canada was limited to promoting the exchange of commodities and goods between the provinces and to fostering the sale of our products to other countries. Conditions are very different now. The Canadian economy is now partly free and partly managed. Our economic and individual freedom is threatened from all sides. The most important duty of the Chambers of Commerce is now to defend private enterprise and to urge the Government to adopt policies favourable to the maintenance of our capitalist democracy. The danger in this mixed economy from which there is no early escape is that we suffer most of the ills of both free enterprise and regimentation. This dangerous situation has compelled the Canadian Chamber of Commerce to concentrate not so much on urging the Government to do something to prevent a depression but rather in trying to stop the Government from doing a hundred things leading towards depression. These activities of the Canadian Chamber of Commerce have been carried out through the various sub-committees of the Executive, the work of which is summarized below.

Economic Development Committee

This Committee has endeavoured to demonstrate to the people of Canada the advantages of the system of private enterprise and to defend capitalism against communistic or socialistic propaganda. The amazing fact is that a system so much abused and so little understood has functioned as well as it has. Convinced that no other system can give a higher standard of living, the Chamber has encouraged the organization of Boards of Trade in the country, and the Economic Development Committee has placed at their disposal the data and the literature needed to demonstrate the advantages of private enterprise over any other politico-economic system. At the suggestion of the Committee, private enterprise was placed on the agenda of the regional clinics held under the auspices of the Field Service Department.

A series of radio scripts under the title of "How is Business?" was prepared for the use of Member Boards and Chambers. Over 100,000 pieces of literature of various types were distributed: among others, "Planning your Future", "This is Business", "Basic Facts" and "Canadian Capitalism and the Menace of a Fifth Column". Members of the Directorate, the Secretariat, and the Speakers' Bureau have addressed over 100 audiences from coast to coast. The Department of Economic Development now publishes twice monthly the "News Letter", with a circulation of over 3,500 copies. This letter brings to the attention of its readers the economic fallacies of the socialistic or communistic propaganda and the advantages of the capitalist democracy. It is felt that this educational programme has brought about a greater understanding of the business men's point of view and of the danger involved in changing from private enterprise to statism.

Labour Management Relations

The relations between labour and management have not been good during 1946, and 4 million man-days have been lost as a result of strikes. Soviet economists base their belief of the inevitability of an American economic collapse largely on the inability of the American economy to operate on a large enough profit. The workers' opposition to increased efficiency and their fight for higher wages, regardless of their effect on costs, constitute grave dangers. The chiefs of the international labour unions now wield power over the life and living of the people greater than any group of business tycoons ever enjoyed. The events of the last year have demonstated that governments are at present powerless against the labour dictators. In Canada, the situation is aggravated by the fact that our industrial activity is, through the working of international unions, controlled by the labour leaders of our greatest industrial competitor.

It is evident from the above that the Chamber's Committee on National Labour Policies was greatly handicapped in its efforts. The Committee, however, during the year, kept a very close watch on legislation and developments in the field of employer-employee relations. When in November 1945, legislation was foreshadowed which would compel the inclusion of provisions for union security in labour agreements, the Chamber strongly opposed the compulsory feature.

The Chamber submitted a statement of view on industrial unrest to the Industrial Relations Committee of the House of Commons in July and August. It made representations to the Unemployment Insurance Advisory Committee on its proposal to amend the schedule of contributions and benefits under the Unemployment Insurance Act. On the invitation of the Minister of Labour, the Special Committee on Labour Relations submitted its views on the Government's proposed revision of the Wartime Wages Control Order.

Public Finance and Taxation

The government, by its fiscal policies, can encourage or discourage business activity and industrial expansion in the country. The only way to reduce costs in the face of increased wages is by the modernization of the industrial machinery. This entails the investment of new money by individuals or by corporations, but the present high income taxes discourage the taking of risks.

The Committee on Finance and Taxation, all through the year, kept close watch on moves and measures in the field of federal finance. Well in advance of the introduction of the budget to Parliament, the views of business, as represented by the Chamber, were placed before the Minister of Finance in a brief recommending several changes. While a number of these recommendations were implemented in the budget, the business community was greatly disappointed at the lack of tax relief, and a public statement expressing this disappointment was released over the president's signature on July 6, 1946.

A brief was presented to the Special Committee of the Senate inquiring into the Provisions and Workings of the Income War Tax Act and the Excess Profits Tax Act, 1940. In March of this year, the Executive reiterated the recommendations, anent co-operatives, which it had made before the Royal Commission in 1945.

As the budget resolutions of October 1945 made no provision for amending the Dominion Succession Duties Act to permit reciprocal arrangements with the United Kingdom to eliminate double taxation, the Chamber recommended that the practicability of an agreement similar to our agreement with the United States should be studied with representatives of the British Government.

Post War Policies

During the past year, the Committee on Reconstruction was entrusted with the study of all questions outside the purview of the other committees. As a result, this Committee had to tackle such controversial questions as control versus decontrol of prices and wages; the best measures to prevent inflation; the regulation of consumer credit, etc. The discussions resulting from these studies, although very interesting to the members of the Committee, did not bring out any unanimity of opinion. The only result was a serial letter commending the government for removing the price ceilings on a selected list of goods and also urging the raising of the 1941 price ceilings and the eventual removal of price controls as the surest method of increasing production and thus preventing price inflation.

The Committee was more successful in its study of the question of immigration and of the remuneration of the civil servants. A memorandum on immigration was submitted to the Prime Minister and, on the invitation of the Royal Commission of Administrative Classification in the Public Service, a submission was made to the Commission.

The Executive Committee made special studies of the following questions: the Dominion-Provincial Conference, the co-ordination of public welfare campaigns, the long term wheat contract with the United Kingdom, land settlement and various phases of rehabilitation and reconversion.

The Chamber expressed its opposition to the government's proposed amendment to the Combines Investigation Act in a brief to the Senate Committee on Banking and Commerce.

International Affairs

The Chamber's Fourth National Foreign Trade Conference of exporters and importers was held in Hamilton on May 8th, 9th and 10th, 1946. More than two hundred delegates were in attendance.

The President and Executive Chairman led a Canadian delegation of six to the Annual Meeting of the United States Chamber at Atlantic City. The President was a featured speaker on the programme.

The Canada-United States Committee, jointly maintained by the two national Chambers of Commerce, held its first post-war meeting at Quebec City in September 1946. The discussion centered on private enterprise in the two countries, the United Kingdom, United States and Canada trade triangle, and bulk purchasing agreements by governments.

The secretarial services were supplied by the Canadian Chamber of Commerce to the Canadian Section of the International Chamber of Commerce, organized a year ago. This organization had made substantial progress under the chairmanship of Mr. R. P. Jellett.

The Foreign Trade Committee, under the chairmanship of Mr. W. D. Jones, has been extremely active. Through this committee and the secretariat, a commercial intelligence service is supplied to foreign trade inquiries. In the past two years a record of several thousand inquiries were handled. In January a summary of the American Trade Proposals for an International Trade Organization was prepared and issued to the membership. In preparation for an International Trade Fair in Canada, in 1948, the Chamber has accepted the government invitation to nominate a representative to the Advisory Committee to the Director of Exhibitions and Mr. Paul Béique, M.E.I.C., will serve in this capacity.

This brief outline of the activities of the Canadian Chamber of Commerce indicates how valuable the work of the Chamber is to Canada as a whole. Several members of the Engineering Institute of Canada took an active part in the work of the Chamber. Dr. J. B. Challies was Chairman of the Executive Committee and Col. R. D. Harkness, Vice-Chairman. Messrs. Paul Béique, P. F. Sise, R. E. Stavert, Arthur Surveyer and H. G. Welsford were members of some of the sub-committees enumerated above and collaborated in the preparation of the submissions made to the government.

Respectfully submitted,

Arthur Surveyer, M.E.I.C.,
Chairman of the Reconstruction Committee of the Canadian Chamber of Commerce. Institute Representative on the Board of the Chamber.

COMMITTEE ON EMPLOYMENT CONDITIONS

In two important decisions, the Wartime Labour Relations Board (National) has largely cleared up the long uncertainty about the status of engineers under labour legislation. The Board made clear that, in its opinion, professional employees come under the provision of current labour laws, and that, as a general rule, they should be segregated from other employees for purposes of collective bargaining. In determining an "appropriate unit", the Board favours the grouping of sub-professional and professional employees engaged in common employment in the same line of skilled work. Classification of employees will thus be on a functional basis. Those employed in a confidential capacity or having the authority to employ and discharge are excluded under the provision of the law. The detailed rulings given by the Board were reported in the July *Journal*.

In a draft bill of The Industrial Relations and Disputes Investigation Act 1947 which is to be presented at the next session of Parliament, there is an ambiguous section in which it appears professional employees could be compelled, against their wishes, to have a labour union bargain for them. Representations are being made to the Minister of Labour that this unsatisfactory condition should be remedied.

Your committee feels that the question of salaries cannot be satisfactorily settled by mere publication of a schedule, because too many variables are involved. Your committee considers that an engineer's compensation must in fact depend on the importance of his work, his ability to produce results, the degree of responsibility carried and many other factors. Job evaluation may be the answer to this complex problem, but much further work remains to be done before something can be produced which will satisfy engineers and convince their employers.

Many of the young men now taking engineering courses are believed to have no intention of continuing technical work after graduation; otherwise, your committee would be apprehensive about the capacity of industry to absorb them.

Your committee wishes to express its deep appreciation and thanks to Dr. Wright and Mr. Trudel and the general Headquarters' staff for their assistance during the year.

Respectfully submitted,

R. E. Heartz, M.E.I.C., *Chairman.*

COMMITTEE ON PROFESSIONAL INTERESTS

Your Committee maintained its contact with the various branches of the Institute and with the cooperating associations. Its members visited many branches and associations and one member, G. J. Currie of Halifax, visited every branch of the Institute. Much benefit was derived by the committee from these contacts and it is hoped that branches and associations also benefited.

It is gratifying to record the inauguration of the Kootenay Branch and the Cornwall Branch during the year, and at this time confidently to predict the inauguration of two more branches during the coming year. This is indicative of the steady growth of Institute strength and membership.

A brief was presented by the Toronto Branch in the interest of closer cooperation and better relations with Headquarters. The reply, made at the time of the April meeting of Council in Toronto, led to a full, frank and friendly discussion which eliminated various misunderstandings.

A suggestion that an Ontario Division of the Institute be established, grew into a resolution that steps be taken to secure a letter ballot as to its desirability. Voting is still in progress.

Due to a change in Institute fees a revision of the By-laws of co-operating associations was found necessary and these revisions are in hand.

Drastic legislation is proposed in the Province of Saskatchewan, which would take from all professions in that province their present power of regulating their own members. The matter is under observation by your committee.

The matter of removal of duty on engineer's plans entering Canada protested by the Institute last July—was referred to this Committee for further action. In co-operation with other interested organizations a resolution supported by a strong delegation was sent to the Minister of Finance. The matter is still under consideration by the Department of Government concerned.

As a result of the cooperative agreement negotiated last year, meetings of the joint committee of the American Society of Mechanical Engineers and the Engineering Institute of Canada were held in New York, and further means of cooperation between the two organizations explored. The joint A.S.M.E.-E.I.C. meeting held in Detroit last summer and attended by our President, J. B. Hayes, O.B.E., was a distinct success.

Your committee has found it desirable to make further statements through the Engineering Journal, special bulletins and letters for the purpose of clarifying misunderstandings of the Institute's position in relation to the Canadian Council of Professional Engineers and Scientists. Proponents of the new organization claim that up to 90% of their members are members of the Engineering Institute. This fact supports the considered opinion of this Committee, as repeatedly endorsed by Council, that it is unnecessary to form a new over-riding body, involving travelling of delegates, operating expenses and duplication of activities. The Institute has therefore continued to decline membership in that organization.

Continuing growth in Institute membership impels your committee to reiterate its statement of one year ago concerning the "urgent need of a field secretary or some officer who could give his attention to branch affairs." It is gratifying to note that this matter is now actively in hand.

The growth of the cooperative movement among engineering societies continued and joint meetings became more frequent. This committee looks forward to the time when all engineering societies in Canada will be linked by cooperative agreements which will preserve their autonomy and provide the fullest measure of cooperation among professional engineering organizations.

Respectfully submitted,

J. B. Stirling, M.E.I.C., *Chairman.*

CANADIAN RADIO TECHNICAL PLANNING BOARD

The second Annual General Meeting of the Canadian Radio Technical Planning Board was held in Montreal on December 10th, 1946.

Since the last Annual Meeting, final reports have been submitted to the Administrative Committee on frequency allocations by all the working panels concerned. Panel A, which is charged with the responsibility of coordinating the reports of other panels, has been very active during recent months and the report of this panel was the main subject of the discussion during the Annual General Meeting.

Panel A, in examining the reports of other panels, found there was a great deal of overlapping in the frequency space required by the various interested groups in Canada and particularly in the medium frequency portions of the spectrum. Panel A is therefore confronted with the extremely difficult task of weighing the merits and priorities of the various services in order to eliminate the present overlapping requirements.

As a result of Panel A's deliberations during the past four or five months, they have put forward a general plan asking the other panel chairmen to review their requirements in the light of this revised plan. It appears that the major conflicts are between those of Panel C dealing with radio communications, including point-to-point, portable, mobile and emergency communication services, and those of Panel E dealing with aeronautical radio and radio aids to navigation.

As a result of the discussions at the Annual Meeting, the chairmen of these panels were requested to review their requirements immediately in the hope that a mutually satisfactory solution can be arrived at between the conflicting interests as soon as possible. It is hoped that Panel A will therefore be able to make a final report for submission to the Department of Transport to be used at the next World Frequency Allocation Conference which will be held sometime before the middle of 1947.

All executive officers were re-elected for the ensuing year, as follows: R. M. Brophy, President; R. A. Hackbusch, Vice-President; S D. Brownlee, Secretary-Treasurer.

The total revenue for the year, consisting primarily of fees from sponsoring members and bank interest, amounted to $1,659.75 and expenditures for the year were $697.78, leaving a surplus of $961.97. To this surplus was added surplus from the previous year of $3,020.26, giving a total surplus as at November 20th, 1946, of $3,982.23.

In view of the amount of surplus on hand at the present time, the annual fees were reduced from $100 to $50, except in the case of the technical engineering societies which have been reduced to a nominal amount of $10; the Engineering Institute is grouped in the latter category.

A. B. Hunt, M.E.I.C.,
Institute Representative on the Board.

JULIAN C. SMITH MEDAL

Carrying out the instructions pertaining to the award of the Julian C. Smith Medal for 1946, the special committee consisting of Past-President K. M. Cameron, deGaspe Beaubien and myself has made a selection of two names, which have been submitted by letter ballot to all councillors.

As a result, Julian C. Smith Medals for 1946 are being awarded to:

Charles Camsell, formerly Deputy Minister of Mines and Resources, Ottawa, Ontario.

John Bow Challies, Vice-President and Executive Engineer, The Shawinigan Water & Power Company, Montreal, Quebec.

Respectfully submitted,
J. B. Hayes, M.E.I.C., *Chairman.*

SIR JOHN KENNEDY MEDAL

The Sir John Kennedy Medal for 1946 has been awarded by the Council of the Institute to Lorne Argyle Campbell, President and Managing Director, West Kootenay Power and Light Company, Limited, Trail, British Columbia.

Respectfully submitted,
L. Austin Wright, M.E.I.C., *General Secretary.*

STUDENTS' AND JUNIORS' PRIZES

The reports of the examiners appointed in the various zones to judge the papers submitted for the prizes for Students and Juniors of the Institute were submitted to Council at its meeting on January 11th, 1947, and accepted as follows:

H. N. Ruttan Prize (Western Provinces) to E. M. Scott, S.E.I.C., for his paper " The Operation and Construction of the Modern Oil Circuit-Breaker ".

John Galbraith Prize (Province of Ontario)—No papers received.

Phelps Johnson Prize (Province of Quebec—English)—No papers received.

Ernest Marceau Prize (Province of Quebec—French)—No papers received.

Martin Murphy Prize (Maritime Provinces)—No papers received.

Abstracts of Reports from Branches

Note—For Membership and Financial Statements see pages 72 and 73

BORDER CITIES BRANCH

The Executive Committee submits the following report for the year 1946.

The branch held twelve Executive Committee meetings during the year and nine general meetings.

The branch was honoured in having Mr. C. G. R. Armstrong appointed Chairman of the Institute Nominating Committee.

The branch membership vastly surpassed their quota in funds for the Harry F. Bennett Educational Fund.

The second of post-war joint annual meetings with the Detroit Section of the A.S.M.E. was held in Windsor. Joint meetings were held with the Independent Association of Electrical Engineers and the Royal Astronomical Society of Canada. Ladies were invited to attend our annual meeting with the Detroit Section of the A.S.M.E.

The branch took an active part in the A.S.M.E. Semi Annual Meeting held in Detroit in June, 1946.

The following is information relative to our general meetings. The attendance is noted in brackets.

Jan. 18—**Inside the Diesel Engine** by R. K. Weldy, Fuel Injection Division of the Ex-Cell-O Corporation, Detroit. (62.)

Feb. 15—**High Speed Railroading** by James E. McCort, District Manager, Railway Division, Timken Roller Bearing Company, Cleveland, Ohio. (29.)

Mar. 22—**Radar** by J. H. Rowlatt, Bell Telephone Company, Montreal. (300.)

Apr. 12—**Material Handling Methods and Equipment** by Glen R. Johnson, Clark Tructractor, Battle Creek, Mich. (55.)

May 1—The annual visit of the Institute president, J. B. Hayes. (45.)

May 31—**The Glories of the Heaven** by W. A. Hare, Hare Engineering Co. of Detroit, Mich. (110.)

Oct. 11—**The Steep Rock Iron Mine—Its General Features and Power Supply** by A. H. Frampton, Assistant Chief Electrical Engineer, Hydro Electric Power Commission of Ontario. (38.)

Nov. 6—**The Electric Home of the Future** by J. W. McWhirter, Appliance Division, Canadian General Electric Company of Canada. (300.)

Dec 6—Annual meeting and election of officers, and award to O. Rolfson, M.E.I.C. (27.)

CALGARY BRANCH

The following report of activities is submitted by the Calgary Executive for the Branch Year 1946, the attendance at meetings being shown in brackets.

The Executive met ten times during the year.

Dec. 13—**Oilwell Drilling in Turner Valley** by J. Wark, Field Superintendent of the Brown, Moyer and Brown Oil Company Limited, and **Accident Prevention** by J. R. Jenkins, Calgary Power Company Limited. (47.)

Jan. 17—Annual Ladies' Night was held at the American Woman's Club under the auspices of the Engineers'

Wives Club. Entertainment consisted of moving pictures and a talk on **Conditions in Wartime Sweden** by Leone MacGregor Heldstedt. (120.)

Jan. 31—**Operation of Railways in France After D-Day** by Lieut.-Col. Wootten, M.C., O.B.E. (40.)

Feb. 14—**Railway Signalling** by W. Abell of the Canadian Pacific Railway. Also a moving picture was shown on "Railroading". (43.)

Feb. 28—**Atomic Energy** by Dr. J. W. T. Spinks, of the University of Saskatchewan. This meeting was held jointly with Calgary Branch of the Chemical Institute of Canada.

Mar. 16—Annual Meeting followed by Dinner. (43.) This meeting was followed by the attendance at the Glencoe Club of the members and wives for bridge.

June 4—Annual western visit of the president, J. B. Hayes. Accompanying Mr. Hayes were: Mrs. J. B. Hayes, G. J. Currie, Councillor of the Halifax Branch, Dr. L. Austin Wright, and Miss McLaren of the Institute Headquarters staff. (101.)

Sept. 26—Sound films showing development of North West Territories and illustrating the salmon fisheries in Alaska and British Columbia were shown. (73.)

Oct. 17—**Urban Transportation** by V. A. Newhall, City Commissioner. (78.)

Nov. 14—**Hydro-Electric Power Development in the Yellowknife North West Territories Area** by Bev Monkman, Calgary Power Company Ltd. (50.)

Nov. 28—**The Need for University Facilities in Calgary** by F. G. Buchanan, Superintendent of Schools in Calgary. (35.)

CAPE BRETON BRANCH

The following dinner meetings were held during the year. In the case of "The Magic of the Spectrum" and "Operation Crossroads" the meetings were considered to be of sufficient general interest to invite the ladies.

Jan. 9—**Housing Research,** by J. L. Gray, Assistant Director General of Research and Development in the Department of Reconstruction. (42.)

Feb. 13—**The Magic of the Spectrum,** by C. A. Morrison, Halifax District Manager, Canadian General Electric Co. Ltd. (75.)

Mar. 28—**Overseas Experiences with the Engineers,** by E. C. Bannerman, together with a showing of "The Mulberry Film". (25.)

Sept. 23—**Manufacture of Carbon Electrodes,** by A. G. Dilks, Sales Engineer, Canadian National Carbon Co. Ltd. (26.)

Nov. 20—**Bluenose Oil,** by Dr. D. J. MacNeil, Consulting Geologist, Antigonish, N.S. (28.)

Dec. 17—**Operation Crossroads,** by Major General R. M. Luton, C.B.E., M.C., late Director General of Medical Services Overseas. Colour movies with descriptive talk. (66.)

CORNWALL BRANCH

The Cornwall Branch was newly organized this year, and received its charter at the Inaugural Meeting on November 22nd, with many Institute officials present.

EDMONTON BRANCH

The Edmonton Branch Executive met eight times during the year, with an average attendance of 7.

The general meetings of the Branch, with one exception, (May 23rd), were dinner meetings at the Macdonald Hotel, starting at 6.30 p.m. The dates, programmes and attendance, which is the figure in brackets, were as follows:

Jan. 17—**Electricity in the Navy**—an illustrated lecture, by Electrical Commander J. Deane, R.C.N. of Ottawa (35.)

Feb. 18—**Jet Propulsion and Future Aircraft**—an illustrated lecture, by Sqd. Ldr. E. L. Baudoux, D.F.C., D.S.O., Edmonton. (73.)

Mar. 29—**Technical Features of 'Mulberry'** by Col. V. C. Steer-Webster, O.B.E., preceding a visit to the exhibition of the Mulberry models, and a private showing of the film "A Harbour Goes to France". This was a joint meeting with the Association of Professional Engineers of Alberta. (114.)

Apr. 24—**Branch Annual Meeting**—Highlights of the year's activities, and election of officers, concluding with a smoker. (44.)

May 13—**Western Visit of the E.I.C. President**—J. B. Hayes—An informal dinner meeting, to which ladies were invited. (79.)

May 23—A special joint meeting with the Science Association of the University of Alberta, in the Medical Building of the University. Sqd. Ldr. R. Kronfeld, A.F.C., of the National Research Council of Canada, gave an illustrated lecture entitled **Gliding and Soaring.** (135.)

Oct. 28—**Canada's Role in the Tantalum and Columbium Industries,** by Dr. Daniel Gardner, of New York, N.Y. Joint meeting with the Canadian Institute of Mining and Metallurgy, and the Chemical Institute of Canada. (116.)

Nov. 25—**Electrical Logging of Bore Holes,** by A. A. Perebinossoff, of the Schlumberger Well Surveying Corporation of Houston, Texas — an illustrated lecture. (48.)

HAMILTON BRANCH

During the past year, the Branch held the following meetings, with attendance as shown in brackets:

Jan. 15—Annual Meeting and Dinner at the Scottish Rite Club, the speaker of the evening being Dr. Sidney Smith, President of the University of Toronto. (78.)

Feb. 21—**Reconstruction in Italy,** by Lt. Col. V. S. Thompson, M.E.I.C., Department of Reconstruction. (45.)

Mar. 28—**The Association of Professional Engineers — Its Objectives and Accomplishments,** by Dr. G. Ross Lord, M.E.I.C., President of the Association of Professional Engineers of Ontario. (100.)

Apr. 26—**Lightning,** by Dr. G. D. McCann, Westinghouse Electric Corporation. This meeting was the annual joint gathering of the Toronto Section of the American Institute of Electrical Engineers, and the Hamilton Branch. (175.)

Apr. 29—**The President's Visit.** A special dinner was held to honour the President, J. B. Hayes, M.E.I.C., Louis Trudel, M.E.I.C., Assistant General Secretary, and Councillor G. J. Currie, M.E.I.C. (40.)

Sept. 26—**Housing in Canada—The Problem and Prospects,** by Brigadier D. H. Storms, General Manager, Housing Enterprises of Canada. (48.)

Oct. 24—**Exercise Musk-Ox,** by Dr. J. T. Wilson, Professor of Geophysics, University of Toronto. (80.)

Nov. 14—**Iraq,** by Mr. Frank Alexander, of the Waterloo Manufacturing Company. This meeting was the annual "Ladies' Night" dinner meeting. (110.)

Dec. 13—**Jet Propulsion—The History and Development of the Westinghouse Aviation Gas Turbine,** by H. J. Clyman, Westinghouse Electric Corporation, South Philadelphia, Pa. This meeting was the annual joint gathering with the Hamilton Sub-section of the American Institute of Electrical Engineers. (140.)

The Executive Committee of the Hamilton Branch held seven meetings during the year, with an average attendance of seven members.

KINGSTON BRANCH

Th following meetings were held during the year:

Jan. 16—Lt. Cmdr. H. G. Burchell—**Electricity in the Navy.**

Feb. —Student Papers Night.

Feb. 21—Wm. Storrie—**The Engineer and Public Health.**

Mar. 21—R. N. Boyd and W. R. Birks—**Air Conditioning.**

Apr. —Col. Sawyer—**Smoke Control.**

July 4—Annual Meeting.

Oct. 7—Tour of Aluminum Co. of Canada, Kingston Works, Dinner Meeting. (64.)

Nov. 4—T. M. Medland—**Collective Bargaining and the Engineer.** (200.)

Nov. 27—Annual Visit of the president, J. B. Hayes, Dinner Meeting. (60.)

KOOTENAY BRANCH

The Kootenay Branch was newly organized this year and received its charter at the Inaugural Meeting in Trail, B.C., on Friday, May 17th. The charter was presented by J. B. Hayes, president of the Institute, to S. C. Montgomery, chairman of the local branch.

Officers of the Institute present at the Inaugural Meeting included: Messrs. L. Austin Wright, G. J. Currie (Halifax), P. M. Sauder (Strathmore, Alta.), C. S. Clendening (Lethbridge, Alta.), Dean R. A. Spencer (Saskatoon), W. G. Carry

(Edmonton), J. G. McGregor (Calgary) and S. Young (Regina).

Three luncheon meetings were held during the year, as follows (attendance in brackets):

May 31—General business meeting including the chairman's report on the recent presidential visit. (16.)

Nov. 5—General business meeting. Film **Carbon-Black Treasure** was shown and a short talk given by Mr. C. Vatcher, of the Canadian National Carbon Co. Ltd. (19.)

Dec. 20—General business meeting. Film **Electronic Light** was shown describing the operation and manufacture of fluorescent lamps. (17.)

In addition to the above, two meetings of the Executive Committee were held during the year.

LAKEHEAD BRANCH

The following meetings were held during the year:

Jan. 28—Fort William. A tour of inspection through the Canadian Car & Foundry Co. plant at Fort William where Brill busses are being manufactured. Mr. Bicknell, of the Canadian Car & Foundry Co. was in charge of the tour. (36.)

Feb. 22—Fort William. **Annual Dance,** held at the Royal Edward Hotel. (60.)

May 28—Port Arthur. **Annual Meeting,** and election of branch officers. (38.)

June 10—Kakabeka Falls. **Halifax During the War Years,** by J. B. Hayes, president of the Institute. Also Dr. L. Austin Wright, General Secretary E.I.C., and G. J. Currie, Councillor of the Halifax Branch spoke. The ladies were present on this occasion. (96.)

Sept. 5—Port Arthur. **The Association of Professional Engineers of Ontario,** by Dr. G. Ross Lord, president of the Association and Col. T. M. Medland, Director of Public Relations of the Association. (53.)

Oct. 19—Fort William. A tour through the Great Lakes Paper Co. mill. S. T. McCavour of the Great Lakes Mill spoke on pulp and paper mills. (33.)

Nov. 15—**Development of the Lakehead Harbours,** by J. R. Mathieson, Assistant Engineer of the Dept. of Public Works of Canada. Also Mr. MacRae, Librarian, Fort William Library showed a sound film entitled "The Great Lakes". (25.)

LETHBRIDGE BRANCH

The following meetings were held by the Lethbridge Branch:

Jan. 25—Dinner meeting. Dr. T. How, district meteorologist of the Department of Transport, Edmonton, spoke on **Arctic Meteorology.**

Feb. 22—Don Livingstone, of the Lethbridge Collieries, discussed the **Bailey Bridge.**

Mar. 13—D. Brown, district service engineer for Canadian General Electric, Lethbridge, spoke on **Electronics.**

May 3—Dinner meeting. G. E. Elkington, M.E.I.C., Manager, East Kootenay Power Co., Fernie, B.C., spoke on the **Power Supply in the Crow's Nest Pass Area.**

May 14—Banquet and meeting. Branch entertained presidential party.

Sept. 21—Dinner meeting. Speaker was Wm. Murday, of Richard Sutcliffe Ltd., Horbury, England, who discussed **Belt Conveyers in Britain.**

Oct. 19—Dinner meeting. The deputy minister of reconstruction for Saskatchewan, E. E. Eisenhauer, M.E.I.C., spoke on **The Farmer in a Program of Reconstruction.**

Nov. 16—Dinner meeting and ladies' night. J. D. Sutcliffe, of London, England, spoke on the **Wavy Navy Ashore and Afloat.**

LONDON BRANCH

The Executive of the London Branch is pleased to report the following ten regular and special meetings:

Jan. 23—Annual Dinner. Guest Speaker, Lt.-Col. B. W. Grover, O.B.E., whose subject was **Intercommunications in the Canadian Army during Operations.**

Mar. 1—Joint Meeting with Association of Professional Engineers of Ontario. Speaker—Dr. G. Ross, London.

Mar. 28—Supper Meeting. Councillors' Report by J. A. Vance, and report on **Thames Valley Conservation Scheme,** by W. R. Smith.

Apr. 17—**Civil Affairs Administration in Italy,** by Lt.-Col. S. W. Archibald, E.D.

May 2—President's Visit—Guests of honour—President and Mrs. J. B. Hayes.

May 18—Plant visit to Borden Company at Belmont and Ingersoll, conducted by J. H. Johnson.

Sept. 12—**Engineering with a Field Company in Italy,** by Maj. W. J. Bright, D.S.O.

Nov. 5—**The London Town Plan,** by Gordon Culham.

Nov. 19—**The Engineer and the War,** by Maj.-Gen. H. Kennedy, C.B.E., M.C.

Dec. 11—Dinner and Films. **Clean Waters** and **The Raindrop and Erosion,** presented by W. P. Willis and W. R. Smith, respectively.

The Branch Executive and special committees met eight times during the year.

MONCTON BRANCH

Three meetings of the Executive were held during the year. There were four branch meetings held, at which technical subjects were discussed and business transacted as follows:

Jan. 10—A meeting was held in the City Hall. B. W. Isner, Manager, Canadian Gypsum Co., gave an address on the **Production and Manufacture of Gypsum Products.**

Mar. 5—A meeting was held in the City Hall. R. N. Fournier, Manager of Supply, Canadian General Electric Co., Halifax, N.S., delivered an address on **Electric Heating in Industry.** The "Mulberry Film" was shown at this meeting.

May 28—A meeting was held for the purpose of nominating branch officers for the year 1946-47.

June 4—The Annual Meeting was held on this date.

MONTREAL BRANCH

The following meetings (attendances are shown in brackets) were held in 1946:

Jan. 10—**Applying Industrial Engineering Techniques Through Supervisors,** by Clifton H. Cox. (150.)

Jan. 17—**St. Lawrence Water Way,** by Prof. John L. MacDougall. (180.)

Jan. 24—**Housing,** by J. L. E. Price, M.E.I.C. (175.)

Jan. 31—**Annual Meeting of the Branch.** (90.)

Feb. 14—**Annual Student Night.**

Feb. 21—**Trends in Central Station Development,** by F. R. Benedict. Joint Meeting with A.I.E.E. (100.)

Feb. 28—**Traffic and Engineering,** by John T. Gibala, C.E. (100.)

Mar. 7—**Outline of Pre-Stressed Concrete Design,** by Col. Jean P. Carrière, P. Eng., M.E.I.C. (180.)

Mar. 14—**The Application of Gas Turbines to Railway Locomotives,** by A. K. Leuthold, M.E.I.C. (175.)

Mar. 21—**Radio-Microwaves and Radar,** by W. H. Doherty. Joint Meeting with I.R.E. & A.I.E.E.. (330.)

Mar. 28—**Fuel Oil Burning as Applied to Commercial Boilers for Industrial Service,** by George P. Haynes. (130.)

Apr. 4—**The Manufacture of Naval Cables and the Part They Played in Hastening Victory,** by N. L. Morgan, M.E.I.C., and S. B. Thomas. (70.)

Apr. 11—**Engineers and Public Policy,** by W. E. Wickenden, D. Eng., D.Sc., LL.D., L.H.D., Joint Meeting with A.I.E.E. (170.)

May 30—**Developments in Reinforced Concrete,** by Prof. G. Magnel, M.I. Struct. E. (215.)

Oct. 3—**Opening Night.—Films** (Refreshments). (280.)

Oct. 10—**Structural Analysis and Strength,** Prof. Hardy Cross, M.A.S.C.E. (200.)

Oct. 17—**Industrial Power Distribution,** by G. M. McHenry. Joint Meeting with A.I.E.E. (180.)

Oct. 19—**Afternoon Visit to Plant of Montreal Coke & Mfg. Co.,** Ville La Salle. (100.)

Oct. 24—**Industrial Engineering and Profit Control,** by Frank L. Sweetser. (220.)

Oct. 31—**Coal-Burning Gas Turbines for Locomotives,** by John I. Yellot, M.A.S.M.E. (210.)

Nov. 5—**Radar in the British Commonwealth,** by Sir Robert Watson-Watt, C.B. (360.)

Nov. 7—**Construction of City Subways,** by Charles E. Deleuw, M.A.S.C.E. (220.)

Nov. 14—**Frequency-Modulation and Television Broadcasting in Canada,** by J. Alphonse Ouimet, M.E.I.C. Joint Meeting with I.R.E. (210.)

Nov. 21—**Visit of the President of The Engineering Institute of Canada,** J. B. Hayes, M.E.I.C. (150.)
Nov. 28—**Design and Construction of Large-Scale Housing,** by John P. Riley, M.A.S.C.E. (150.)
Dec. 5—**Gyroscopes in Transportation,** by Capt. C. B. Potts. (100.)
Dec. 12—**The Polymer Plant, Sarnia,** by G. R. Henderson, M.E.I.C. (150.)

JUNIOR SECTION

Considering that papers constitute the backbone of the activities of any professional society, it was decided this year to let the members choose their own subjects. A survey through the mail indicated that non-technical subjects were preferred.

Thanks must be given to Mr. J. D. McPherson, Chairman of the Papers Committee, who conducted the survey and also approached most of the speakers.

The addition of a Telephone Committee was made so that all members could be reminded of coming events. This Committee saw to the distribution at meetings of breast-pocket name cards, a practice designed to familiarize members with one-another's face and name.

The result of these new policies was an increase in interest of the Juniors and Students for the activities of their section.

The second Annual Dance was held at the Ritz-Carlton Hotel with great success. All available tickets were sold before the dance and among the 500 people present we were happy to count Mr. J. B. Hayes, Mr. J. A. Beauchemin and Mr. J. B. Stirling and their Ladies.

Again, as in the past, the Film Night attracted a full house of members and their friends.

Here follows a list of meetings.

Feb. 25—**Annual Meetings—Reports,** (Refreshments) (125.)
Mar. 18—**Film Night** (210.)
Apr. 8—**The Engineer and his Relation to Human Progress,** by A. P. Young, O.B.E. (65.)
May 6—**A.C. Reactors,** by J. M. Rousseau, JR.E.I.C. (50.)
Oct. 7—**Opening Night: Tomorrow's Challenge to the Young Engineer,** by A. W. Whitaker, Jr., M.E.I.C. (Refreshments). (205.)
Oct. 21—**Outline of Business Management,** by G. H Kimpton, M.E.I.C. of Stevenson & Kellogg. (120.)
Nov. 4—**Effective Speaking,** by D. A. McDonald. (90.)
Nov. 18—**Principles of Production,** by Mr. R. Marien. (85.)
Nov. 29—**Annual Dance,** (500.)
Dec. 9—**Psychology and You,** by Dr. E. C. Webster. (110.)

NIAGARA PENINSULA BRANCH

The Branch Executive held four (4) executive meetings and one (1) electoral meeting during the year. The programme committee arranged for and conducted the following general professional meetings.

Jan. 17—Dinner Meeting at the General Brock Hotel, Niagara Falls, Ont. Joint meeting with the Association of Professional Engineers of Ontario, addressed by Dr. G. R. Lord, M.E.I.C., President of the Association of Professional Engineers of Ontario.
Feb. 28—Dinner Meeting at the Queensway Hotel, St. Catharines, Ont. The speaker was Dean C. R. Young, M.E.I.C., of the University of Toronto, on the subject of **Engineering Development.**
Mar. 28—Dinner Meeting at the Red Casque Inn, Niagara Falls, Ont. The guest speaker was Mr. H. Little, M.E.I.C., Sales Manager of R. & N. Bearings, Canada, Limited who spoke and showed films on **The Manufacture of Ball Bearings.**
Apr. 30—The president of the Institute, Mr. J. B. Hayes, was the guest speaker at this presidential meeting, which was held at the Hotel Leonard, St. Catharines, Ont. Mr. Hayes was accompanied by G. J. Currie, M.E.I.C., Councillor of the Halifax Branch and Louis Trudel, Assistant Secretary of the Institute.
May 28—Annual Meeting at the Park Restaurant, Niagara Falls, Ont. Colonel Herbert D. Vogel, Corps of Engineers, United States Engineer's Office, Buffalo, N.Y., presented an address on **Operations of Engineer Troops in the South Pacific.**
Oct. 24—A Dinner Meeting was held at Leonard Hotel, St. Catharines, Ont., at which Mr. W. C. Effrick, General Sales Manager, Canadian Carborundum, Limited, presented films and a discussion on **Romance in Industry.**
Nov. 28—Dinner Meeting at the Red Casque Inn, Niagara Falls, Ont. Mr. J. D. Millar, Deputy Minister Department of Highways of Ontario outlined and presented films on **The Highways of Ontario.**

OTTAWA BRANCH

The following meetings were held during the year (attendance being shown in brackets):

Jan. 10—Annual Evening Meeting, Auditorium of the National Research Council — **Experiences of the European Trip,** by Allan C. Ross, who had attended the 27th Session of the International Labour Conference held at Paris. (75.)
Jan. 29—Joint Evening Meeting with the Ottawa Branch of the American Institute of Electrical Engineers, Auditorium of the National Research Council—**Looking Ahead with Telephone Scientists,** by G. L. Long, Historian of the Bell Telephone Company. (75.)
Feb. 13—Luncheon Meeting, Chateau Laurier, **Some Impressions of German Wartime Metallurgy,** by Dr. G. S. Farnham, at that time Chief Metallurgist of the Department of Mines. (85.)
Mar. 7—Luncheon Meeting, Chateau Laurier—**Are We Our Brothers' Keeper,** by H. J. McGough, General Manager of the Ontario Highway Construction Safety Association. (90.)
Mar. 22—Evening Meeting, Lecture Hall of the National Museum — **An Outline of Pre-Stressed Concrete Design,** by Col. J. P. Carrière. (60.)
Apr. 5—Luncheon Meeting, Chateau Laurier—**The Engineer and His Relation to Human Progress,** by A. P. Young, O.B.E., of London, England. (65.)
Apr. 18—Luncheon Meeting, Chateau Laurier—**The Canadian National Railways' Contribution to the War Effort,** by S. W. Fairweather, Vice-President of the C.N.R. in charge of Research and Development. (100.)
May 2—Luncheon Meeting, Chateau Laurier—A film entitled **No Keener Blade,** shown through the courtesy of the Canadian Liquid Air Company (102.)
May 31—Evening Meeting, Lecture Hall of the National Museum — **Pre-Stressed Concrete Design,** an illustrated talk by Professor Magnel, University of Ghent, Belgium. (60.)
Sept. 18—Evening Meeting, Auditorium of the National Research Council—A showing of Scientific Films.
Oct. 16—Evening Meeting, Lecture Hall of the National Museum—**The Development of the Bailey Bridge,** an illustrated talk by Sir Donald Bailey. (200.)
Nov. 1—Evening Meeting, Lecture Hall of the National Museum—**The Use of Coal Burning Gas Turbines in Locomotives,** by Mr. John I. Yellott, of Baltimore. (75.)
Nov. 26—Dinner Meeting, Chateau Laurier—In honour of Mr. J. B. Hayes, President of the Engineering Institute of Canada. An illustrated talk **The Atomic Bomb Tests at Bikini,** by Air Vice-Marshal E. W. Steadman, C.B., O.B.E. (160.)
Dec. 19—Luncheon Meeting, Chateau Laurier—A film entitled **Clean Waters,** shown through the courtesy of the Canadian General Electric Co. (100.)

PETERBOROUGH BRANCH

The following meetings were held during 1946, with attendance shown in brackets:

Jan. 10—Mr. Paul Clark, Aluminum Company of Canada—**The World's Aluminum Industry and Canada's Relation to it.** (51.)
Feb. 14—Messrs. Dick, Parr, Danks, Canadian Ingersoll Rand—**Compressed Air in Industry.** (51.)
Mar. 14—Mr. J. P. Sesia, Faircraft Industries of Canada—**Factory Built Homes.** (93.)
May 15—Annual Meeting—Guest Speaker R. H. Spencer, Bell Telephone Company—**Your Voice as Others Hear It.** (65.)
June 22—Annual Picnic. (76.)
Oct. 26—Trip to Kingston as guests of Aluminum Company of Canada. (60.)
Nov. 21—Dr. E. G. Faludi, Town Planning Consultants, Limited—**Town Planning in Peterborough.** (94.)
Nov. 27—Annual Dinner. (56.)
Dec. 12—Dr. H. Moore, Stevenson & Kellogg, **Management Engineering.** (49.)

Branches	Border Cities	Calgary	Cape Breton	Cornwall	Edmonton	Halifax	Hamilton	Kingston	Kootenay	Lakehead	Lethbridge	London
MEMBERSHIP												
Resident												
Hon. Members	..	..	..	..	..	..	..	2	..	..	.	..
Members	53	112	35	15	90	187	104	46	17	32	17	55
Juniors	24	44	4	6	32	21	33	23	4	9	2	22
Students	4	14	6	7	32	37	27	40	4	5	1	17
Affiliates	0	1	1	1	1	1	1	1	..	6	..	3
Total	81	171	46	29	155	246	165	112	25	52	20	97
Non-Resident												
Hon. Members	..	..	..	..	..	..	..	..	..	..	..	..
Members	12	18	28	3	16	74	24	4	6	19	15	1
Juniors	4	6	9	4	9	3	22	2	4	2	8	1
Students	7	3	4	..	2	13	16	4	3	10	3	1
Affiliates	...	..	1	..	..	..	1	..	..	..	..	..
Total	23	27	42	7	27	90	63	10	13	31	26	3
Grand Total December 31st, 1946	104	198	88	36	182	336	228	122	38	83	46	100
" December 31st, 1945	85	161	77	..	138	360	175	106	..	79	52	69
Branch Affiliates, December 31st, 1946	..	49	..	13	..	..	12	..	..	..	12	2
FINANCIAL STATEMENT												
Balance as of December 31st, 1945	380.69	460.22	607.47	..	204.77	334.24	153.36	99.73	.. ..	220.95	208.96	182.48
Income												
Rebates from Institute Headquarters	192.15	60.13	77.10	82.35	33.00	122.15	140.46	123.24	50.00	120.84	19.95	126.14
Payments by Professional Assns	..	254.94	123.61	..	260.44	488.70	..	..	..	..	59.10	..
Branch Affiliate Dues	..	169.00	..	46.25	..	..	40.00	..	..	..	45.00	8.00
Interest	10.41	45.25	9.11	..	..	.78	30.78	.67	..	..	52	3.00
Miscellaneous	712.50	..	348.50	349.83	150.20	372.81	299.37	1.55	..	372.50	6.02	257 85
Total Income	915.06	529.32	558.32	478.43	443.64	984.44	510.61	125.46	50.00	493.34	130 59	394.99
Disbursements												
Printing, Notices, Postage①	49.43	144.66	24.81	3.00	46.84	130.80	145.47	34.32	..	40.80	52.57	36.05
General Meeting Expense②	763.70	76.01	..	..	145.93	4.50	..	64.14	..	349.74	74.00	10.00
Special Meeting Expense③	..	452.07	432.09	365.79	6.75	259.15	256.31	..	4.97	175.51	85.40	324.49
Honorarium for Secretary	..	22.50	..	..	50.00	50.00	..	..	..	10.00	25.00	..
Stenographic Services	15.00	10.00	10.00	..	17.70	97.80	50.00	..	..	..	..	..
Travelling Expenses④	..	35.00	..	..	..	..	62.60	..	..	..	..	..
Subscriptions to other organizations	..	..	..	..	..	..	..	..	..	..	..	..
Subscriptions to *The Journal*	..	34.25	..	10.15	..	..	4.00	..	..	..	..	2.00
Special Expenses	58.36	15.00	..	..	141.60	64.69	..	65.21	..	..	11.90	8.79
Miscellaneous	..	25.45	..	..	1.20	14.10	55.80	..	..	3.00	20.13	65.00
Total Disbursements	886.49	814.94	466.90	378.94	410.02	621.04	574.18	163.67	4.97	579.05	269.00	446.33
Surplus or *Deficit*	28.57	*285.62*	91.42	99.49	33.62	363.40	*63.57*	*38.21*	45.03	*85.71*	*138.41*	*51.34*
Balance as of December 31, 1946	409.26	174.60	698.89	99.49	238.39	697.64	89.79	61.52	45.03	135.24	70.55	131.14

①Includes general printing, meeting notices, postage, telegraph, telephone and stationery.
②Includes rental of rooms, lanterns, operators, lantern slides and other expenses.
③Includes dinners, entertainments, social functions, and so forth. ④Includes speakers, councillors or branch officers.

OF THE BRANCHES AS AT DECEMBER 31, 1946

Moncton	Montreal	Niagara Peninsula	Ottawa	Peterborough	Quebec	Saguenay	Saint John	St. Maurice Valley	Sarnia	Saskatchewan	Sault Ste. Marie	Toronto	Vancouver	Victoria	Winnipeg
..	1	..	1	..	..	..	..	..	..	..	..	1	..	1	..
26	1212	76	328	40	126	56	53	64	37	107	18	523	186	53	175
4	394	37	79	28	31	26	14	32	19	33	6	202	50	10	65
9	672	24	52	32	50	7	9	16	2	6	2	250	83	8	108
..	30	1	6	15	2	0	3	1	..	..	2	10	5	..	4
39	2309	138	466	115	209	89	79	113	58	146	28	986	324	72	352
..	..	..	..	..	..	..	..	..	..	..	..	..	1	..	..
31	103	6	35	14	18	6	59	3	1	44	46	10	39	11	17
9	32	..	14	9	3	4	17	5	..	11	21	7	8	7	11
19	33	..	11	8	3	6	51	..	..	60	17	4	12	2	14
..	2	..	..	3	1	1	..	1	..	..	..	1	2	..	1
59	170	6	60	34	25	17	127	9	1	115	84	22	62	20	43
98	2479	144	526	149	234	106	206	122	59	261	112	1008	386	92	395
87	2176	114	688	102	196	108	189	101	28	247	70	668	318	71	293
3	11	7	20	..	..	..	18	..	..	..	6	..	1	1	9

*For voting purposes only, there should be added to Montreal Branch, an additional 392 members, 239 being resident in the United States, 89 in British possessions and 64 in foreign countries.

Moncton	Montreal	Niagara Peninsula	Ottawa	Peterborough	Quebec	Saguenay	Saint John	St. Maurice Valley	Sarnia	Saskatchewan	Sault Ste. Marie	Toronto	Vancouver	Victoria	Winnipeg
168.56	2,549.33	191.11	562.13	191.07	200.16	207.81	272.30	211.09	32.80	50.24	169.73	767.15	500.76	169.20	646.62
42.64	3,362.36	254.94	636.65	127.29	279.19	166.87	44.68	150.67	38.93	19.68	106.89	732.77	363.76	107.39	318.87
90.00	..	..	..	..	..	..	180.00	..	..	379.61	..	..	2.49	..	..
15.00	73.00	..	96.00	30.00	..	..	36.00	..	..	..	53.00	..	..	3.00	45.00
3.73	30.00	12.75	60.46	1.84	..	..	..	..	..	..	15.12	8.80	6.01	..	28.50
..	761.43	..	..	2.50	1,084.48	69.00	..	..	308.00	..	74.25	113.23	..	92.50	347.45
151.37	4,226.79	267.69	793.11	161.63	1,363.67	235.87	260.68	150.67	346.93	399.29	249.26	854.80	372.26	202.89	739.82
20.71	2,149.91	56.10	222.47	87.52	66.73	14.41	63.31	54.53	10.24	79.89	37.07	559.40	94.88	33.39	274.09
2.50	123.00	57.60	18.00	23.85	40.93	31.50	7.50	49.68	72.15	169.88	146.95	87.50	57.65	9.50	49.50
..	975.59	49.99	286.20	9.17	1,017.63	143.37	63.40	53.38	237.50	..	..	179.66	84.67	147.59	22.60
25.00	400.00	75.00	..	..	100.00	25.00	40.00	..	..	..	25.00	100.00	50.00	35.00	75.00
10.00	120.00	10.00	75.00	..	..	..	15.00	5.00	..	72.00	..	40.00	20.00	..	..
..	289.55	8.00	..	..	..	..	..	..	..	35.49	..	..	..	..	..
..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
7.00	42.00	..	..	12.00	..	..	34.00	..	..	..	24.00	12.15	..	..	18.00
..	115.00	13.25	20.00	..	30.00	..	..	..	..	..	..	56.07	..	..	30.90
7.82	99.80	..	60.06	1.65	24.04	10.65	29.90	7.83	10.30	22.35	34.40	60.00	23.91	5.00	348.87
73.03	4,314.85	269.94	681.73	134.19	1,279.33	224.93	253.11	170.42	330.19	379.61	267.42	1094.78	331.11	230.48	818.96
78.34	*88.06*	*2.25*	111.38	27.44	84.34	10.94	7.57	*19.75*	16.74	19.68	*18.16*	*239.98*	41.15	*27.59*	*79.14*
246.90	2,461.27	188.86	673.51	218.51	284.50	218.75	279.87	191.34	49.54	69.92	151.57	527.17	541.91	141.61	567.48

QUEBEC BRANCH

The programme of activities was as follows (attendance is given in brackets):

Jan. 16—**Electricity in the Navy.** Lt.-Cmdt. J. G. Ferraris, R.C.N.V.R. (41.)
Feb. 25 **Some Notes on Engineers and Engineering.** Lt.-Col. E. D. Gray-Donald, Quebec Power Co. (125.)
Apr. 4—**Radar.** W. A. Laurie, Bell Telephone Company. (76.)
Apr. 29 **Transport par Autobus, hier, aujourd'hui et demain.** C. H. Boisvert, Chairman of the Branch. (70.)
May 29 **Béton armé — Béton pré-contraint.** Professor G. Magnel, Head of the department of civil engineering at the University of Ghent, Belgium. (60.)
June 3—Annual Meeting of the Branch. (20.)
Sept. 9—Annual Golf Tournament. (90.)
Nov. 1—**L'Après-guerre en Allemagne.** Dr. P. E. Gagnon and Dr. Roger Potvin of Laval University. (46.)
Nov 18—**The President's Visit.** (75.)
Dec. 9—**Recent Developments in the Use of Carbon and Graphite.** A. G. Dilks, electrical engineer, Canadian National Carbon, Montreal. (35.)

SAGUENAY BRANCH

During the year the Branch held a total of nine general meetings:—

Jan. 31—**Industrial Electronics—To-day and To-morrow,** by J. D. Willis, Assistant Manager, Industrial Division of the Apparatus Department, Canadian General Electric Co., Toronto, Ont.
Feb. 19—**The Romance of Gold Mining,** by A. H. Tait, Manager of Mistassini Exploration Company, Arvida, Que. This program also included a sound color film entitled "River of Paper" by Powell River Co.
Mar. 29—**Canadian Technical Investigator Tours Europe after V-J Day,** by R. W. Herzer, Aluminum Company of Canada, Ltd.. Montreal, Que.
Apr. 26—**Parks for Use of the People,** by G. F. Todd, Landscape Architect, Montreal, Que.
May 28—**Magic of the Spectrum,** by M. Laflamme, Lighting Service Engineer, Canadian General Electric Company, Montreal. This meeting was held jointly with C.I.C.
June 26—Annual Dinner Meeting held in the Grill Room of the Saguenay Inn for the purpose of meeting the Institute President, Mr. J. B. Hayes.
Sept. 24—**How Student Architects View Arvida and District,** by Gordon Webber, Instructor in visual design, McGill University. Also **Town Planning in Postwar England,** by Mr. Spencer Sales, Assistant Professor of Architecture, McGill University, Montreal.
Nov. 5—**Yacht Racing,** by D. M. Jemmett, Professor of Electrical Engineering, Queen's University.
Dec. 5—**Exploitation of the Caustic Chlorine Industry in Germany,** by Dr. W. C. Gardner of the Mathieson Alkali Works Inc.

In addition to the above, the Junior Section held six general meetings and a dinner meeting.

SAINT JOHN BRANCH

The Executive held ten meetings during the year with an average attendance of seven members.

Six general meetings of the Branch were held during 1946, five at the Admiral Beatty Hotel in Saint John, and one, a public meeting, in the Saint John High School.

Jan. 24—Annual Joint Dinner of the Branch and Association —A. S. Donald. Chief Highway Engineer, Department of Public Works, N.B., spoke on the **Construction of the Goose Bay Airport.** (78.)
Feb. 21—Dinner Meeting at which Mr. J. W. MacDonald, Resident Engineer, N.S. Light and Power Co. spoke on the **12,500 k.w. Steam-Electric Station of the N.S. Light and Power Company.** (36.)
Mar. 21—B. W. Isner, Manager, Canadian Gypsum Company, Hillsborough, spoke on the **Production and Manufacture of Gypsum Products.** (26.)
Apr. 17—Dr. G. C. Laurence of the National Research Council addressed a public gathering in the Saint John High School on **Atomic Energy.**
Oct. 29—A. V. Tracy-Gould spoke on **A General Outline of the Manufacture of Kraft Paper.** (32.)
Nov. 21—Mr. R. M. Doull, General Manager of Canada Gunite Company spoke on the **Reconstruction of the Halifax High Service Reservoir.** (54.)

An Annual Meeting was held at the end of April, 1946. At this meeting it was decided by ballot that the Annual Meeting of the Branch should be held on or before the second Tuesday in December instead of on or before the second Tuesday in May, thus coinciding with the date of the Annual Report required for the E.I.C. in December. The Branch Officers elected at this Annual Meeting will hold office until the Annual Meeting in December, 1947. In accordance with the above an Annual Meeting was held at the Admiral Beatty Hotel on December 12. The Annual Branch Report for the year ending December 31, 1946 was presented and vigorous discussions took place on matters of current E.I.C. interest.

ST. MAURICE VALLEY BRANCH

During the year 1946, the following general meetings were held:

Jan. 9—Lecture Meeting: T. A. Carter of the Aluminum Co. of Canada spoke on **Some Aspects of Engineering in India.** The lecture was illustrated.
Jan. 29—Dinner Meeting: A. B. McEwen of the Defense Industries Limited spoke on **Design and Construction of Munition Plants in Canada.**
Feb. 8—Lecture Meeting: J. H. Rawlatt of the Bell Telephone Co. of Canada spoke on **Radar.** This meeting was joint with the Chemical Institute of Canada.
Apr. 13—Annual (Luncheon) Meeting: P. L. Pratley, Consulting Engineer, spoke on **Preliminary Considerations for Bridge Projects.** The results of the annual elections were announced and the new officers of the Branch installed in office.
Oct. 22—Lecture Meeting: G. M. McHenry of the Canadian General Electric Co. spoke on **Industrial Power Distribution.**
Nov. 20—President's Visit: Always a highlight of the Branch Activities, this year's visit from Mr. J. B. Hayes was no exception. Mr. Hayes, Mr. Heartz and Mr. Trudel, all spoke briefly after a dinner held in the main dining room of the Chateau de Blois in Three Rivers.

SARNIA BRANCH

This was the first full year of operations of the Sarnia Branch, having been officially organized as a branch in October 1945. During the year there were eight general meetings including the annual meeting, and the executive held ten meetings. A list of the general meetings with speakers and subjects, follows:

Jan. 24—A joint E.I.C. and C.I.C. meeting, held in St. George Hall. The speaker was E. Smith of the Dow Corning Corporation, his subject being **Silicones.**
Feb. 28—A dinner meeting at the Sarnia Golf Club with 33 members present. The speaker was I. G. Goddard, of the Canadian General Electric Co. who spoke on **Plastics.**
Apr. 4—A dinner meeting at the Sarnia Golf Club with 24 present, with Mr. T. J. Holme. of the Canadian G.E. Co. as speaker. His subject was **Electronics.**
May 9—A dinner meeting at the Sarnia Golf Club with 24 present. The speaker was Mr. C. F. Davison, of the Dominion Salt Co., speaking on **Salt.**
June 14—This was the occasion of the president's visit, and a dinner meeting was held at the Golf Club, to which the ladies were invited. President Hayes, and Dr. L, Austin Wright both addressed the meeting. The attendance was 52.
Oct. 3—A. E. K. Bunnell of Toronto addressed a dinner meeting at the Polymer Cafeteria, with 30 present. His subject was **The Engineer and Community Planning.**
Nov. 21—A dinner meeting at the Polymer Cafeteria with Dr. M. K. Inman of the University of Western Ontario as speaker. Twenty-six heard his address on, **The Gold Standard, and the International Monetary Fund.**
Dec. 5—The annual meeting, at which thirty-four attended. Reports of committees, the election of officers, and a discussion of local problems, were followed by a social evening.

SASKATCHEWAN BRANCH

All meetings were held jointly with the Association of Professional Engineers. The respective programmes were as follows:

Jan. 18—Discussion on Collective Bargaining, followed by social evening.

Feb. 13—Annual Meeting addressed by Col. Steer-Webster on **Mulberry.**

Apr. 4—Regular meeting addressed by Dr. E. G. Faludi on **Principles of Town Planning.**

June 7—Special meeting addressed by J. B. Hayes, president; L. Austin Wright, Gen. Sec'y., and G. J. Currie, Councillor.

Oct. 25—Regular meeting addressed by W. H. Prevey on **G. E. Fault Selective Protection on Distributive Systems.**

Nov. 15—Regular meeting addressed by G. E. Kent, with technicolor film **Search Unending.**

Dec. 12—Regular meeting addressed by W. L. Bunting with film showing restoration of wild bird breeding places.

The average attendance at these meetings was 35.

Ten meetings of the Executive were held during the year.

SAULT STE. MARIE BRANCH

During the year 1946 the Sault Ste. Marie Branch held three executive committee meetings and six general meetings. The general meetings were:—

Feb. 22—**Prepakt Concrete,** by William Johnson, Intrusion Prepakt Company Limited, Toronto.

Mar. 29—**Algoma Steel Corporation North Ore Dock Extension,** by Carl Stenbol, Algoma Steel Corporation Limited, Sault Ste. Marie, Ont.

Apr. 6—**Artificial Harbours,** by W. D. Adams, Algoma Steel Corporation Limited, Sault Ste. Marie, Ont.

June 12—Visit to the Branch by President J. B. Hayes and General Secretary Dr. L. Austin Wright.

Nov. 29—**Fundamentals of the Oxy-Acetylene Process,** by Gordon N. Sale, Dominion Oxygen Company Limited, Sault Ste. Marie, Ont.

Dec. 30—Annual Dinner and Induction of Officers. The average attendance at the general meetings was 22.

TORONTO BRANCH

The executive held seventeen meetings, with an average attendance of nine.

Regular meetings of the Branch are listed below, with the attendance given in brackets:

Jan. 10—**Developments in Concrete Practice and Construction,** by R. A. Crysler. (67.)

Jan. 24—**Student Night** — (Joint with Junior Section):
—**High Speed Flight and its Difficulties,** by G. Rosenthal.
—**Earth Dams,** by W. Finley.
—**Variable Speed A.C. Motors,** by N. R. Buchanan.
—**Cemented Carbides,** by J. R. Moore. (182.)

Feb. 14—**Electric Transportation,** by C. M. Davis. (48.)

Feb. 21—**The Profession of Engineering**—10 speakers and general discussion. (152.)

Mar. 7—**New Frontiers for Chemistry,** by H. H. Lank (joint with Chemical Institute of Canada.) (28.)

Mar. 14—**Aircraft Gas Turbines,** by W. Boyd (joint with A.S.M.E.) (170.)

Mar. 28—Annual Meeting—**Looking Ahead with Telephone Scientists,** by G. L. Long. (79.)

Apr. 26—**Presidential Visit**—President Hayes. (62.)

June 3—**Pre-stressed Concrete,** by Prof. G. Magnel. (110.)

Oct. 4—**Exercise Musk-Ox,** by Dr. J. T. Wilson. (390.)

Oct. 24—**Community Planning**—Panel Discussion, by R. F. Legget, A. Adamson, R. Dobbin, P. A. Deacon, J. F. MacLaren, J. Layng, H. Scott, (joint with Ontario Association of Architects.) (127.)

Nov. 1—**Engineers' Dance,** joint under Affiliated Engineering and Allied Society, and University of Toronto Engineering Alumni Association. (1,386.)

Nov. 28—**Toronto's Smoke Problem,** by Professor A. E. Allcut. (184.)

Junior Section

The primary aims of the Junior Section have resolved themselves into a consideration of the social, economic and professional problems as well as technical problems and also into a concerted effort to promote the interests of the Institute. A special drive to obtain student interest has been launched. The secondary aim has been to point out to non-members of the Institute that they can associate themselves with the Junior Section. The schedule of meetings for the past year follows:

Jan. 24—Student's Night. (180.)

Feb. 4—Dinner meeting, technical. (60.)

Mar. 4—Relation of E.I.C. with C.C.P.E. & S. (150.)

Mar. 19—Plant trip, Victory Mills. (70.)

Apr. 2—Annual meeting. (40.)

Oct. 8—Jet Propulsion. (225.)

Nov. 12—Dinner meeting, Atomic Energy, Frequency Modulation, Salary Survey. (110.)

Nov. 21—Plant trip, Consumers Gas. (80.)

Nov. 27—Ajax meeting, Pres. Hayes. (800.)

Dec. 11—Job Evaluation & Wage Incentive. (65.)

All meetings have been made more interesting by the showing of one or two movies and the presenting of an attendance prize.

VANCOUVER BRANCH

Dec. 11, 1945—Brian Perry, Consulting Engineer, of Montreal, on **Development of Plant and Manufacturing Methods for Penicillin.**

Jan. 21, 1946—Electrical Commander Deane of the Royal Canadian Navy on **Electricity in the Navy.**

Feb. 13—Student Night with Gordon Heal of the Student Branch, presiding. The three speakers were Gordon Ellis, speaking of **Ripple Rock;** Dave Bakewell on **Detailed Topographic Maps for Logging;** and Tom Scott, who represented the University Engineering Students' Branch at the Annual Institute Convention held in Montreal, gave a report on their deliberations.

Mar. 21—M. O. Paquette, Chief Engineer of Stevenson & Kellogg, Ltd., gave an outline of **Modern Scientific Approach to Job Evaluation and Personnel Problems.**

Apr. 16—Annual Ladies' Night—held at the Hudson's Bay Store, viewing "Operation Mulberry". This was an exceptionally fine evening, with members, their wives and friends, gathered to view the British War Office's model exhibit of the preparations for the beach landings undertaken in the invasion of Europe. The personnel was headed by Col. Steer-Webster of the British War Office. The Hudson's Bay Company very kindly served lunch on that occasion.

May 22—President's Dinner held at Stanley Park. President Hayes was accompanied by our genial Secretary Dr. Austin Wright and Councillor G. J. Currie from Halifax.

Oct. —Professor Forward of the University of British Columbia spoke on his recent trip to China.

The attendance at our meetings has been very gratifying, ranging from 45 to 75 at our meetings, 85 at last year's annual meeting and an attendance of about 550 members, ladies and friends at the Annual Ladies' Night. It has been the Executive's policy to co-operate with the Association of Professional Engineers, because of our very close mutual interest, and they have received an invitation to all meetings. Your Executive Member, Mr. Noel Lambert, who is also a member of the Council of the Profession, placed before that body our desire for closer co-operation in arranging joint meetings.

VICTORIA BRANCH

During the year there were four meetings of the executive committee and seven general meetings of the branch. The branch meetings may be summarized as follows:

Jan. 3—**Annual meeting.** This was a luncheon meeting held in Spencer's Dining Room.

Mar. 7—General meeting. **Snow Surveys** by Major R. C. Farrow, M.E.I.C., vice-chairman, Victoria Branch.

May 10 to 18—**Mulberry.** During this week, the Mulberry Exhibit was shown under the auspices of the Hudson's Bay Company and the Engineering Institute of Canada at the Bay Street Armories. A dinner meeting was held by the Hudson's Bay Company to which the members of the Victoria Branch of the Engineering Institute were invited. The meeting was addressed by Col. Steer-Webster, Commanding Officer of the Exhibit.

May 27—Presidential Dinner. A dinner was held in honour of the President on Monday evening, May 27th, at the Empress Hotel. There were forty-five members and ladies present. The meeting was addressed by Mr. Hayes, President, and by Mr. Currie, Councillor from the Halifax Branch, and also by Dr. Wright.

May 28—General business meeting in the Oak Bay Municipal Hall. President Hayes addressed the meeting on the growth of the Engineering Institute of Canada, the impressions gained on his trip across country and on the part played by the Engineers of Canada in the War Effort. Mr. Currie brought greetings from the other Branches across the Dominion and also particularly from the Halifax Branch. The main address of the evening was given by Dr. Wright who spoke on a number of subjects of interest to the engineering profession. A considerable amount of discussion followed Dr. Wright's informative address.

Nov. 28—Luncheon meeting for the purpose of selecting a slate of nominees for office in the Victoria Branch for 1947.

Dec. 16—Annual meeting of the Branch for the purpose of electing an executive committee for the year 1947. The meeting was addressed by Major-General W. W. Foster on **Developments in Northern Canada.**

WINNIPEG BRANCH

Late in 1945 Electrical and Student Sections of the Branch were formed and after a full year's operation it can be reported that the results are very satisfactory. Below are listed the meetings held by the Branch and the two sections. The Branch general meetings are frequently held jointly with the A.P.E.M.

The Branch Executive has held 10 meetings during the year with an average attendance of 10.

Jan. 10—**Field Engineering for Military and Naval Construction,** E. V. Gilbert, M.E.I.C. and Lt. Col. W. A. Capelle, M.E.I.C.—Dept. of Public Works, Dominion Government, E.I.C.-A.P.E.M. (60.)

Jan. 14—**Centralized Control of a Power System,** Mr. Perry Peterson, Chairman Automatic Stations Committee A.I.E.E. and President Control Corporation, Minneapolis—E.I.C., Elec. Sect. E.I.C., A.P.E.M. (68.)

Feb. 7—**Annual Meeting of the Branch**—Following various reports and installation of the new Executive, a moving picture " The Big Duck Factory " was shown under the auspices of " Ducks Unlimited " E.I.C (67.)

Feb. 25—Film " No Keener Blade " shown and described by Mr. Dunn, Canadian Liquid Air Company.
The Present Situation in Respect to Housing Under the Veteran's Land Act. Informal talk by Mr. Bruce Johnson, District Construction Supervisor.
The Wildwood Housing Project. Informal description of this local housing project. (400 units) by H. S. Bird, M.E.I.C., Pres. Bird Construction Co. Ltd. This was a dinner meeting held at the St. Regis Hotel. E.I.C.—A.P.E.M. (84.)

Apr. 2—**The Shipshaw Power Development**—F. L. Lawton, M.E.I.C., Assistant Chief Engineer, Aluminum Company of Canada Ltd., Montreal. Illustrated. E.I.C.—A.P.E.M. (69.)

May 9—**President's Visit**—Pres. J. B. Hayes spoke informally to the Branch. Halifax Councillor G. J. Currie brought greetings and Gen. Sec. L. A. Wright spoke on Institute affairs. This was a luncheon meeting held in Hudson's Bay Company Dining Room. E.I.C. (62.)

Oct. 24—**Inflation**—Prof. W. J. Waines, Dept. of Political Economy, University of Manitoba E.I.C.—A.P.E.M. (66.)

Nov. 21—**Early History of Canada** — Rev. Father Antoine d'Eschambault, Chancellor of the diocese of St. Boniface. This was a dinner meeting held in the Marlborough Hotel. E.I.C.—A.P.E.M. (54.)

Electrical Section

The following meetings were held by the Electrical Section of the Winnipeg Branch during the year 1946.

Jan. 14—Perry Peterson, Chairman, Automatic Stations Committee A.I.E.E. and President of Control Corporation of Minneapolis, spoke on **Centralized Control of a Power System.** (66.)

Mar. 14—W. A. Trott of Greenlaw & Trott — Consulting Engineers, spoke at the inaugural dinner meeting of the Section on **The Technique of Modern Lighting.** The members and their wives heard several prominent members of the engineering profession give their well wishes to the Electrical Section on this memorable occasion. (62.)

Apr. 25—C. E. Tremblay, formerly chief Engineer of Radio Station C.J.O.B., spoke on the **Design of a Broadcasting Station from Studio at Antenna.** This meeting was followed by an inspection of the studios of C.J.O.B. (25.)

May 9—W. A. Cole, Ground Station Radio Engineer for Trans-Canada Airlines, spoke on **Radar Principles and Applications.** This talk was illustrated with slides and samples. (43.)

Oct. 10—M. D. Young, General Superintendent of Distribution for City of Winnipeg Hydro Electric System, spoke on **Factors and Features in an Urban Distribution System.** Mr. Young covered some of the problems peculiar to Winnipeg including the joint use of poles. (44.)

Nov. 7—C. H. Dahl, Manager of Transportation for the Winnipeg Electric Company, spoke on **Modern Trends in Urban Transportation.** Mr. Dahl outlined some of the modernization plans of his company for improving service to the citizens of Winnipeg. (38.)

Dec. 5—An open Forum on **Electronics** was led by Professor E. R. Love after a Canadian Westinghouse Film " Electronics at Work ", was shown. The principal speakers of the evening were: J. D. Peart of Northern Electric who spoke briefly on **The Development of Telephony;** V. C. Jones of the C.P.R. Communication Department discussed **Carrier Communication;** while E. W. Wirtanen of the Canadian General Electric, outlined the **Principle of the Amplidyne** and a few of its applications. The discussion period following was one of the best experienced by the Section. (47.)

Dec. 10—A special meeting of the Electrical Section was called to hear Mr. J. T. Thwaites, Division Engineer—Electronics of the Canadian Westinghouse Company, speak generally on **Electronics.** This was one of the most interesting meetings of the Section and was called on short notice when it was learned that Mr. Thwaites would be in Winnipeg. (40.)

Student Section

The Student Section Executive has held two meetings with an average attendance of 8.

Jan. 22—Election of officers by Mr. C. P. Haltalin, Chairman Winnipeg Branch E.I.C., Mr. H. L. Briggs gave a short talk on the aims of the E.I.C., Mr. Eric Bergenstein, as Manitoba representative for the Student Conference at the Annual Meeting of the E.I.C. in Montreal, asked for discussion topics. Meeting held at Broadway Site at 8.00 p.m. (60.)

Feb. 15—**Carrier Current Control,** L. A. Bateman. JR.E.I.C. **Report on E.I.C. Annual Meeting,** Eric Bergenstein, S.E.I.C. Election of Student Officers. Meeting held at Broadway Site at 8.00 p.m. (54.)

Mar. 20—**Construction of an Electric Light Bulb** and **Dare Devils** Films. Discussion by Ernest Scott on Summer Correspondence. Meeting held at Fort Garry Site at 12.30 p.m. (60.)

Oct. 25—**Purpose of the E.I.C.,** Dean E. P. Fetherstonhaugh, M.E.I.C. **Opportunities of the Young Engineer in Canada,** M. A. Lyons, M.E.I.C. Meeting held at Broadway Site 8.00 p.m. (40.)

Nov. 27—**Soil Mechanics,** Mr. G. B. Williams, Dept. of Public Works, Manitoba, supported by film. Meeting held at Broadway Site 8.00 p.m. (54.)

From Month to Month

News of the Institute and other Societies, Comments and Correspondence, Elections and Transfers

NEW LABOUR LEGISLATION

The Institute's Committee on Employment Conditions has been studying the draft of a bill which it is proposed will replace the much discussed order-in-council 1003. It is identified as "The Industrial Relations and Disputes Investigation Act 1947". Two changes of importance have been noted, i.e., the word "professional" now appears for the first time in the definition of an employee, and the word "profession" appears alongside the word "craft" in clause 10. Herewith are the relevant contexts:

> "employee" means a person employed by an employer to do skilled or unskilled manual, clerical, technical or professional work.
>
> *and—*
>
> Where the majority of a group of employees of an employer who belong to a craft or profession, by reason of which they are distinguishable from the employees as a whole, are separately organized into one trade union pertaining to the craft or profession, if the group is otherwise appropriate as a unit for collective bargaining, the trade union may apply to the Board and shall be entitled to be certified as the bargaining agent of the employees in the group.

These clauses indicate clearly that the professional worker is now to be included in the groups embraced by the order. Not everyone knows that in the definition of "employee" in the original Order 1003 it was never the intention of the framers of the legislation to include the professions. The word "technical" in the Order was taken by the Committee of Fourteen to mean professional, but it has been disclosed that that was not the intention of the Department of Labour. The new order however is different.

In the beginning of negotiations the Committee of Fourteen pressed for collective bargaining rights for the professional worker, but always with the reservation that its complete control should be in the hands of the profession. Eventually collective bargaining agencies were set up in Ontario and Quebec under the aegis of the registration bodies, and after considerable intensive work these agencies were recognized by the National and Provincial Labour Boards. Unfortunately however the Boards ruled that in applying for the bargaining rights for any group of professional workers, the agencies had to include also the non-professional workers in the same unit. For example, in the engineering department of an employer the agency would have to accept representation for draughtsmen, tracers, blue-printers, stenographers, and so on, as well as for engineers.

In the opinion of many people, these rulings have ruined the situation for engineers, because the non-professional employees in a unit might well outnumber the professional, and therefore by their numerical superiority take control, and in the course of time vote the unit into a trade union. In fact, the unions themselves have seen in the bargaining agencies established for engineers, a ready recruiting agency or a semi-ready union for themselves. This is precisely the sort of thing the Committee of Fourteen tried to avoid, but the Board rulings have dealt the Committee's ideas a fatal blow.

Right from the beginning there were many engineers who maintained that collective bargaining was not good for the profession—and was not feasible. Circulated in 1944 the Institute questionnaire showed that a strong majority wanted complete exclusion from the Order if the profession could not have control of its own bargaining. Therefore today the committee finds itself in the position of petitioning the Minister to separate the professional workers from the non-professional in collective bargaining or to exclude them entirely from the order.

The *Journal* is informed that recently the Ontario federation declined to accept the bargaining certification granted by a Board—although they had applied for it—because the Board insisted they include the non-professionals as well.

The *Journal* is informed also that the Corporation of Professional Engineers of Quebec has just reversed its stand, and now asks the Minister of Labour that engineers be excluded from the new order. It believes that the Board's interpretations have put the engineers into an impossible position, and that the best hope for the future is to get back to where the entire group is excluded, being subject only to provincial legislation.

After referring to "the decreasing membership of the federations," their message to the Minister states, "it is evident that the wish of professional engineers is that their interests be served through the medium of their professional societies or associations, without need of recourse to the machinery of collective bargaining under the auspices of labour laws".

These two developments make serious reading. It is evident that the well-meant efforts to obtain bargaining for engineers have not produced the results desired by everyone. Just what the future holds no one can say, but there should be no difference of opinion as to the unfavourable treatment up to now, nor as to the hopes for the future. If the profession cannot have complete control of its own affairs, it should endeavour to escape entirely from the order.

DIAMOND JUBILEE MEETING

The programme for the Annual Meeting at the Royal York Hotel, Toronto, next May, is taking definite shape and it will be possible in the next few weeks to send detailed information together with the necessary cards for reservations. In the meantime, the following outline may be of interest.

The annual meeting of Council will be held on May 7th. The annual general business meeting will take place on the morning of May 8th. General A. G. L. McNaughton will speak at lunch on atomic energy; a technical session on the same subject will follow in the afternoon under the chairmanship of Dr. C. J. Mackenzie. A smoker is being organized by the Junior Section for that evening.

Friday the 9th will be devoted to technical sessions covering various branches of engineering.

The annual banquet and dance are scheduled for Friday the 9th.

SIR FREDERICK HANDLEY PAGE IN MONTREAL

From time to time the Institute has an opportunity to entertain some distinguished visitor from outside Canada. It was only a short time ago that Sir Robert Watson-Watt was the luncheon guest of the officers of the Institute, and on February 26th Sir Frederick Handley Page similarly honoured the Institute.

Sir Frederick who is founder and head of the well known firm of aircraft manufacturers bearing his name, is in Canada as leader of the United Kingdom delegation to the meeting of the Provisional International Civil Aviation Organization (PICAO) dealing with air worthiness. He is also president of the Royal Aeronautical Society, and in this capacity was host to the president and general secretary of the Engineering Institute in London, England, last September.

Other guests of the Institute included two associates of Sir Frederick's, namely Dr. E. P. Warner, president of the Interim Council of PICAO, and Sir James Cotton, head of the United Kingdom permanent delegation to PICAO.

President J. B. Hayes flew from Halifax to meet the guests, but in the short interval before his arrival Vice-President Armstrong presided.

Sir Frederick spoke in some detail of industrial conditions in England, dwelling particularly on the labour situation. Without minimizing the emergency he expressed the opinion that things were not as bad as reported. While naturally not enthusiastic about a labour form of government, he felt that the good men in the present government—of which there were many—would work out the problems satisfactorily. He had great faith in the British workman—in his industry, his integrity and his insistence on good government. He was confident that the native conservatism of the people would prevent the country from becoming too radical or going communistic.

In conclusion, Sir Frederick extended the good wishes of the Royal Aeronautical Society to the officers and members of the Institute. The luncheon was held at the Engineers' Club, Montreal.

INDUSTRIAL RELATIONS IN GREAT BRITAIN

It is pretty well recognized everywhere that economic conditions in Great Britain are not as favourable as could be desired. It is apparent too that the British people propose to do something about it. A recently issued White Paper sets down some interesting facts for the benefit of employers and trade unions, who through the National Joint Advisory Council are endeavouring to prepare for the government a statement on all matters affecting industrial relations.

The paper begins by emphasizing the great need of the United Kingdom for a considerable sustained increase in the production of goods of all kinds. The biggest problem is the shortage of manpower. "The country has six years of civilian work to catch up, in addition to repairing a vast amount of bomb damage and rebuilding the blitzed areas."

In addition, the United Kingdom must pay her way abroad. As a result of the war she has incurred debts, and lost half her overseas investments—and their income. Britain imports more than half her food and most of her raw materials. To make up, she must increase her exports. At present, though she exports more goods than in 1938, she imports only 70 per cent of that year's imports. Yet Britain cannot even pay for this low amount of imports except by using the Canadian and U.S.A. loans.

The wage rate increase since July 1945, reckoned in terms of the 1945 Wage Bill, means some $1,000,000,000. The total increase since the beginning of the war, in terms of the 1939 Bill, is some $4,800,000,000. "The Government and the country desire that these gains should be made secure and become a permanent advance in real wages. How is this desire to be achieved?"

The statement says "the answer first and last is by increasing production. At present there is too much money chasing after too few goods". Over $28,000,000,000 of income (after income tax has been paid) is trying to buy some $24,000,000,000 worth of goods and services.

"We must concentrate on increasing production in those home industries which supply the vital materials required for the necessities of life. This is not only essential if we are to achieve the standard of life which full employment should ensure, but it is even more urgent in the short run to break the shortage of basic materials which is holding up the whole process of reconversion of civilian life and industry".

CUSTOMS DUTY ON ENGINEERS' PLANS

Following an exchange of letters and telegrams with the Department of Finance dating back to July 1946, representatives of the Institute appeared before the Minister of Finance—the Hon. Mr. Abbott—on Thursday, January 23rd, as joint delegates with the Corporation of Professional Engineers of Quebec, to protest the removal of protective tariffs against engineers' plans entering Canada from other countries.

The delegation emphasized the points raised in the resolutions that had been sent to the Minister previously (see December *Journal*, p. 725) and asked that the protection be restored. Without wishing in any way to encourage the Government to remove the protection on architects' plans, the delegation pointed out the inconsistency of removing the duty on engineers' plans but leaving it on architects' plans, when both sets of plans might well be for different parts of the same project.

The Minister was sympathetic without being committal, and asked that the interview be followed up with a memorandum reviewing the points and the argument.

The delegation was made up of E. A. Ryan, deGaspé Beaubien, R. E. Chadwick, R. S. Eadie, N. B. MacRostie, J. G. Chênevert, Marc Boyer and the general secretary. A delegation from the Canadian Council of Engineers and Scientists was also present consisting of G. B. Langford, T. M. Medland, Hazen Sise and Mrs. M. L. White.

ONTARIO ASSOCIATION ELECTS NEW PRESIDENT

At its twenty-fifth annual meeting held in Toronto on January 18th, the Association of Professional Engineers of Ontario announced the election of Dr. George B. Langford as its president for the year 1947. Dr. Langford is professor of mining and geology at the University of Toronto. Recently he has been on loan to the Ontario Department of Planning and Development as director. Dr. Langford has taken a prominent part in the affairs of the profession in Ontario and was particularly active in the work of the Committee of Fourteen during its negotiations on collective bargaining.

ONTARIO HYDRO NEWS

Certainly the news of the month for the profession is that Dr. T. H. Hogg, chairman and chief engineer of The Hydro Electric Power Commission of Ontario, has been asked for his resignation. Mr. Drew, Premier of Ontario, has stated in the press and over the radio that Dr. Hogg has failed to keep him informed of the activities of the Commission and therefore he proposed to dispense with his services.

The examples which Mr. Drew gives through the press to illustrate Dr. Hogg's derelictions of duty are not very convincing. To an outsider it would seem that there must be more behind the story than has yet been made public. However the fact remains that the Commission is a government appointed organization, and hence is subject to government control; therefore Dr. Hogg would have no alternative but to resign. The press reveals that his resignation was submitted on January 31st.

This is the second example of a chief engineer of this Commission being removed from office peremptorily. There is no suggestion of incompetency. When Dr. Gaby was removed in 1934, engineers across Canada were very critical of the government's action. They are not likely to be less critical in the case of Dr. Hogg.

It is no part of *Journal* policy to become involved in political issues, but there is some significance in these developments for the engineer or other professional worker which can be discussed appropriately in these columns. It is apparent that the engineer accepting employment with a government—any government, municipal, provincial or federal — faces a hazard which is not found in other employment. Not only is he liable to dismissal for incompetence as in any other employment but he may become a victim —even an innocent victim—of a political exigency or expediency.

Engineers are not distinguished for their political sagacity and therefore it might be well for them to keep in mind the hazards of government appointments. The salaries offered for such employment are not so attractive that one can afford to neglect these possibilities. What has happened in the Ontario Hydro may well be considered seriously by engineers everywhere.

Later Developments

Since the news of the attack on Dr. Hogg, Mr. Drew has announced a programme of investigation of the Hydro. Chief among the agencies employed for the purpose is a firm of American engineers. Citizens everywhere may well be surprised that a government would choose to spend the taxpayers' money with a foreign organization, when Canadian consulting engineers are fully competent to do the work. No country in the world has better hydraulic engineers than Canada, and certainly there are no people who know Canadian conditions as well as Canadians.

In spite of the eminence of Canadian engineers in this field it would be hard to imagine an American state employing a firm of Canadians to carry out a similar investigation in the United States. Canada does not equal or excel the States in many things, but here at least is one field in which Canadians have no superiors, and yet the business is denied to them. Perhaps it will be contended that as the firm has a small contact office in Toronto, it can be considered as a Canadian organization. To make such a claim would be simply to beggar the question.

Here is another stirring example of how we drive our citizens into the United States. If governments cannot give Canadian work to Canadians how can others be expected to do so?

NATIONAL RESEARCH COUNCIL APPOINTMENT

An appointment of interest and importance to Canadian engineers was announced on January 24th by the Right Honourable C. D. Howe. Dr. David A. Keys, Macdonald Professor of Physics at McGill, has been made vice-president of the National Research Council, in charge of the overall atomic energy establishment at Chalk River, Ont.

This appointment marks a change in management at Chalk River. Heretofore the operation of the plant has been in charge of Defence Industries Limited, but, with the appointment of Dr. Keys, all phases of the plant activities become the responsibility of National Research Council.

Dr. Keys, who as vice-president will be the senior resident officer in charge, is one of Canada's most distinguished physicists with a long and impressive experience in research, scientific education and administration. Born in Toronto, he attended Upper Canada College and had a brilliant record at the Universities of Toronto, Harvard and Cambridge where he obtained Doctorate of Science degrees. He joined the staff of McGill University in 1922.

During the war of 1914-18, he saw service in the Anti-submarine Division of Admiralty, and during the years since has contributed many valuable papers to scientific societies. Dr. Keys is a Fellow of the Royal Society of Canada, has served on innumerable scientific and technical committees during the war, is a member of the National Research Council, and has a great deal of experience on the administrative side of research work and general scientific activities.

CANADIAN CONSTRUCTION ASSOCIATION CHANGES

It was fitting that the Canadian Construction Association should tender a complimentary luncheon to J. Clark Reilly to mark his retirement after twenty-eight years of service as general manager. The luncheon was a feature of the 29th Annual Meeting of the Association held in Niagara Falls on January 14th, 15th & 16th, 1947.

Mr. Reilly, a graduate of McGill, has been an integral part of the construction business for many years, although his early training was designed to fit him for the Methodist ministry. After his return from the first world war he found no opening in a pastoral charge so he turned to the Association of Canadian Building and Construction Industries, which subsequently became the Canadian Construction Association, and there he has remained, rendering a unique service to the industry and to his country.

Mr. Reilly has been succeeded by R. G. Johnson who has been assistant manager for several months. To Mr. Reilly the Institute expresses its appreciation of his splendid cooperation, and to Mr. Johnson it extends its best wishes for success in his new responsibilities.

MUNICIPAL MANAGEMENT AS A CAREER FOR ENGINEERS

The idea of having a professional man as manager and executive officer of a municipality, responsible to an elected council, was first tried in Staunton, Virginia, in 1908. Dayton, Ohio, was the next to try it six years later. The idea has met with such success that today about one-fifth of all American cities with population between ten and one hundred thousand, and one-fourth of all cities exceeding this size are run by managers, most of whom are engineers.

In 1914, an International City Managers' Association was founded to form a medium to exchange information, and to aid in the improvement of local government administration. Its numbers and activities have expanded greatly and it now supplies management information service, conducts an institute for training in municipal administration, and publishes authoritative statistical information.

Briefly, the main features of a council-manager government are: A council, elected at large, determines all municipal policies which are not set forth in the charter itself, adopts ordinances, votes appropriations, and is required to appoint a chief executive officer, called the manager. The council is the governing body, and the manager is wholly responsible for carrying out the policies which it determines. It is definitely understood that the council deals with administration only in a formal manner, through the manager, and that administrative functions are at no time delegated to committees or individual members of the council.

The manager should be selected on the basis of his training, ability and experience. He provides the council with information which enables it to determine municipal policies, advises the council in matters of policy if the council so desires, and executes the policies determined by council. He introduces the best principles of administrative organization and practice, and is held responsible for the proper co-ordination of all departmental activities under his direction.

In the province of Quebec, where lie the majority of Canadian municipalities using this form of government, authority for setting it up is given by the Cities and Towns Act of the Province. The actual decision to adopt such form of government rests with the council itself, although the approval by ballot of the general electorate may be required.

It is obvious that such a form of administration is more efficient in every aspect of the work. It saves time and work for the members of the council, who are usually not remunerated, and who usually have had no special training in the departments they administered under the old regime. It can reasonably be expected that it reduces inefficiency by eliminating patronage.

In Canada, relatively few municipalities have adopted the system, and those who have are mostly in the province of Quebec. There is no doubt, however, that as it becomes known to those who desire efficient government, it is more widely adopted.

Engineers, being trained to reasoned and systematic thinking, are well equipped for positions as managers, and the code of professional ethics to which they subscribe assures the moral approach to the work which is so necessary in municipal administration. It is essential however that any man undertaking this work shall have a proper understanding of the duties which he must assume, and a real and thorough interest in civic government. Municipal management offers a career which members of the profession may well consider.

A further advantage not to be overlooked is the opportunity such positions afford for establishing a home among pleasant surroundings. Too often an engineer must choose between a job " out in the bush ", far away from home and civilization, where his family cannot be with him for want of schooling facilities, or work in the big city, where living costs are higher, and fresh air and a garden are only a nostalgic dream.

C.C.A. CONVENTION AT NIAGARA FALLS

The 29th Annual Convention of the Canadian Construction Association was held at the General Brock Hotel at Niagara Falls, Ont., on January 14th, 15th and 16th.

Following a welcoming luncheon address by His Worship W. L. Houck, Mayor of Niagara Falls, and a few words by the Honourable Humphrey Mitchell, Minister of Labour, Alan C. Ross, Ontario Vice-President, read the annual address of C.C.A. President, Albert Deschamps, O.B.E., who was unable to attend, due to an unfortunate accident.

Mr. Deschamps pleaded for a " balanced construction program ". This was being advocated by the industry to reconcile competing demands for housing and industrial, commercial, institutional and engineering construction. Essential construction, he pointed out, included such types as low priced and low rental housing, industrial projects to provide jobs and assist in obtaining a share of world trade, expanding facilities for producing materials, roads to help the tourist industry and development of our resources, new power projects for overcoming existing shortages and for supplying power for new industries.

" We believe ", continued Mr. Deschamps, " that . . . elimination of all construction other than housing . . . would seriously hamper Canada's reconversion program ". As examples of certain types that should be deferred until 1948 at least, he named theatres and other places of amusement, summer cottages, and luxury homes. He believed the industry had carried out the maximum of housing construction that was possible with material available for that type of construction. Speaking of labor relations, he stated that union recognition and union rights carry with them moral responsibilities. Some unions were fully seized with this fact and to them all commendation was due. But the principle of union responsibility is one which calls for legislation in every province to avoid repetition of the excesses the nation so bitterly experienced in 1946. He closed by appealing to all to be zealous in keeping costs of construction within reason by self control, when all controls are lifted.

The afternoon session included an illustrated talk prepared by Dr. T. H. Hogg, Chairman of the Ontario Hydro, delivered by R. L. Hearn, Chief Engineer. The subject was the St. Lawrence Seaway, and what quantities were involved in the various component structures. The speaker traced the growth of Ontario's power load since before the war and the steps taken to meet the growth in demand, stressing the province's need for the million horsepower which was Canada's share of the potential capacity in the International rapids section only. The project would employ from 2,500 to 3,000 workers for a period of six years.

Mr. Hearn was followed by W. J. Leclair, Secretary Manager of the Canadian Lumbermen's Association, who painted a somewhat gloomy picture of the lumber supply situation over the next few years and blamed government controls for the current shortages and black market operations.

A fleet of Hamilton buses conveyed visiting members to a smoker in Buffalo for the evening, held at the Town Casino Club.

The second morning was taken up in discussions of the various resolutions prepared by the Resolutions Committee for consideration by the membership as a whole. A "Clark Reilly Luncheon" followed in honour of the retiring General Manager of the Association, J. Clark Reilly. Mr. E. Roland Gilley, Vice President for British Columbia, occupied the chair. J. M. Pigott, Past President, sketched in humorous and touching words, the history of the Association and the invaluable part in its growth and success played by Clark Reilly, presenting him on behalf of the Association with a very handsome silver tray.

The afternoon session was opened with addresses on the current materials supply situation, by Coordinator of Building Materials, Wilbur Uren, of Reconstruction and Supply, and by Robert Drummond, Ontario Vice President and Chairman of the C.C.A. Materials Committee. The latter outlined the Committee's recommendations made last spring for improving the supply situation, while the former acknowledged the value of the assistance given by the Committee to the government, telling how recommendations had been implemented, and explaining why it was impossible to take the actions suggested in the case of certain recommendations.

After further addresses by J. L. E. Price on veterans housing and vocational training, and reports from chairmen of general and trade contractors, roadbuilders and manufacturer's sections, the meetings adjourned for the President's reception and annual dinner, at which the principal speaker was the Honourable Dana Porter, Ontario Minister of Planning and Development, speaking on behalf of the Honourable George Drew, Premier of Ontario.

The third day was taken up with sectional meetings and unfinished business, a farewell luncheon, and an address by John Flood of Saint John, N.B., describing the recent Brussels Meeting of the I.L.O., which he and J. Clark Reilly had attended in December as delegates from the Construction Industry of Canada. The afternoon was occupied in moving adoption of reports and resolutions, and with the election and installation of officers for the ensuing year.

Resolutions passed included pleas for further increasing the output of building materials, for cooperation between management, organized labour and government in stepping up production, in cutting costs of materials and in speeding erection, in the field. The Dominion was asked for surveys and statistics to enable house builders to better schedule their supply and manpower needs both regionally and locally. Extension and improvement of the Dominion provincial program for training of tradesmen and apprentices was demanded, as well as the appointment of officers for vocational guidance in schools. The building and improvement of roads which will encourage resources development and the tourist trade, was advocated.

METAL CUTTING DATA

This is the name of a monthly magazine published by the American Society of Mechanical Engineers. It was developed during the war, and while it was sponsored by the U.S. War Production Board, the developing, assembling and publishing of the information was the work of an A.S.M.E. Committee. Its publication as an A.S.M.E. activity was recently undertaken because of the continuing need in peacetime for the unique service which such a magazine can render.

The publication is designed to keep its readers informed of new and unusual developments in cutting tools, tool materials, and machine methods. It provides:

—first-hand information on the practical application of carbides to boring, broaching, drilling, grinding, milling, reaming, turning and other types of machine tools;

—concise data on new uses of standard and specially designed cutting tools;

—results of important research laboratory investigations undertaken to determine tool life, tool wear characteristics; influence of cutting speeds upon tool life; power requirements and surface roughness when using different types of tool materials, etc.;

—clear and informative illustrations of special tools, tool holding equipment; tool wear; and actual machining operations;

—an annotated bibliography of important articles in current technical periodicals on metal cutting problems; also a list of new books on the subject.

The information is published on 8½ by 11 in. punched, loose-leaf pages, and is obtainable at $1.25 a month or $15.00 a year. There is no special price for members of either the A.S.M.E. or the E.I.C.

Subscriptions should be entered with The American Society of Mechanical Engineers, Publication Sales Department, 29 West 39th St., New York 18, N.Y.

ANNUAL FEES

Members are reminded that a reduction of one dollar is allowed on their annual fees if paid before March 31st of the current year. The date of mailing, as shown by the postmark on the envelope, is taken as the date of payment. This gives equal opportunity to all members wherever they are residing.

SOUTH AFRICAN LETTER

A member of the Institute, who has recently taken up residence in South Africa, has undertaken, at our request, to send, periodically, news which might be of interest to *Journal* readers. Mr. W. O. Maclaren lived in Canada from 1924 to 1939 and was engaged in structural design work in Niagara Falls and later in Toronto. In 1939, he went to England to work with Sir Alexander Gibb and Partners, consulting engineers. During the war, Mr. Maclaren was employed with the Ministry of Aircraft Production and later joined the firm of Brian Colquhoun and Partners, consulting engineers, London, England. Here is Mr. Maclaren's first South African Letter.—Ed.

Some five months ago I was asked by our firm to visit South Africa to investigate the advisability of opening a branch of our London firm of consulting engineers in Johannesburg, or elsewhere in the Union. After some difficulty with the Government departments in England I was given passage on one of the C-class flying-boats made by Messrs. Short Brothers of Rochester, England, in 1936, and I had an extremely comfortable trip to Durban, South Africa. My route was via Marseilles, Malta, El Adem, Cairo, Khartoum, Malakal, Kisumu, Dar-es-Salaam, Mombasa, Beira, Mozambique and Lourenco Marques. It was a most interesting and enjoyable journey.

I then flew from Durban to Johannesburg, and was interested to see that, although this city is only 60 years old, it is a fine modern and friendly city. I met a large number of charming and helpful people in a short time and after two weeks made up my mind I would recommend strongly that we open an organization in South Africa. I was fortunate to also meet several Cabinet ministers and leading industrialists, who filled me with optimism about the future developments in this enormous country.

Within four weeks I was again bound for Johannesburg via Durban for the purpose of opening an office here. On my arrival in Johannesburg I was fully prepared to acquire at once a suite of six or seven offices to house our staff. This was urgent, as I had already made arrangements to send staff out from England because of shortages of technical staff in South Africa. After contacting almost every estate agent in Johannesburg, I was finally fortunate in obtaining one small office, on loan from an acquaintance.

We are now well established in South Africa, but I would warn those who are proposing to come to the Union of some serious shortages which will retard the establishment of new enterprises in the Union. First, there is the severe shortage of accommodation. Unless one has friends in high quarters it is almost impossible to obtain office accommodation of any kind in the city, particularly since offices change hands when they do become available, long before any estate agent even hears about them.

The second serious shortage is that of telephone facilities. The local exchanges are much too small, instruments are scarce and it is almost impossible to obtain even one new telephone. The third shortage is that of living accommodation. After four months in a hotel in Johannesburg, my wife and I finally found a small furnished house in a fairly good district of Johannesburg at a rental of £30 a month after having turned down one offer at £100 a month, another at £80 a month and two offers of most unsuitable houses at £60 a month. Unfurnished houses are impossible to obtain, and flats, or apartments do not appear to exist at all. Any that become vacant are immediately transferred to friends or are offered furnished at exorbitant prices. Those considering coming out to South Africa, particularly Johannesburg, should not expect to find suitable accommodation within six months. Do not arrange for any members of your staff to come over until you have arranged living accommodation, and have assured yourself that office accommodation is available, together with telephone facilities.

There are also the grave questions of shortages of building materials, particularly shortages of cement and steel. The cement position is likely to improve within the next twelve months, as new plants are now being designed and will shortly be constructed, while existing ones are being extended. The position regarding steel supplies is likely to remain acute for a number of years. Steps are now being taken to extend steelworks and to build new ones.

The climate is almost ideal, although at times we shall undoubtedly yearn for a good Canadian winter. After leaving gloomy and fogbound England it is pleasant to see the sun every day, and although this is alleged to be the rainy season, the sun almost invariably returns and is indeed welcome. There is so much opportunity for recreational exercise that the biggest difficulty is in finding time to do any work.

The biggest single organization here concerned with engineering development is the Railways and Harbours Administration, which controls the construction, operation and maintenance of all railways and harbours in the Union. The Railways Department is now surveying thousands of miles of new track and is building new harbours, together with the immediate construction of three large airfields, in Johannesburg, Durban and Cape Town. This, of course, is only part of the Railways' interest in immediate development, as they are also ordering large quantities of locomotives and rolling stock of all kinds for immediate use and later expansion.

The large mining groups are also looking to the future, particularly with regard to the enormous engineering development which must come in the Orange Free State. It has been known, of course, for some time that the Orange Free State contains large gold deposits, and the first new leases for development of these gold deposits were granted by the Government last week. Others are bound to follow, and the development of the Orange Free State and a large expanse of country south-south-west of Johannesburg is bound to follow.

Two major problems have to be faced in this country very shortly. First, there is likely to be a very grave shortage of water in the Union of South Africa, and it is my considered opinion, shared with many others, that the future development of the Union will be in direct ratio to the amount of water which can be made available. Steps are being taken, almost daily, to implement the water supply in dry spots in the Union, but I am sure until some government department takes immediate and aggressive steps to bring huge quantities of water from outside the Union into the country, the shortage of water will become more acute with every year that passes.

The second important problem is the ratio of coloured to white population. This stands at about three coloured to one white. The Government is presently sitting in Cape Town and is debating the question of the new immigration policy for the Union. Most of us who are interested in the long-term development of this magnificent country are hoping that a strong immigration policy will follow quickly, and as there appears to be few Canadians here, I should not be surprised if we see many more in the near future.

With kindest regards to all who may remember me,

W. O. Maclaren, M.E.I.C.

Johannesburg, January 30, 1947.

MEETING OF COUNCIL

A meeting of the Council of the Institute held at Headquarters on Saturday, January 11th, 1947, convening at nine-thirty a.m.

Present: Vice-President J. E. Armstrong (Montreal) in the chair; Councillors P. E. Buss (Thorold), S. R. Frost (Toronto), J. A. Vance (Woodstock), Paul Vincent (Quebec), R. S. Eadie, C. C. Lindsay and J. B. Stirling of Montreal; Treasurer J. A. Lalonde (Montreal) General Secretary L. Austin Wright and Assistant General Secretary Louis Trudel.

National Construction Council: Mr. Stirling presented a letter received by the Institute from the National Construction Council which made certain inquiries as to what the Institute wanted the Council to do about the removal of controls, particularly on items which affect the construction industry. The letter contained three questions.

After a thorough review, Council's decisions on these points were as follows:

1. Any objection to the Council itself moving to obtain the removal of controls.

The Institute's decision on this is that the National Construction Council should take no action. The Institute believes that it is no part of the function of the National Construction Council to speak on behalf of its constituent members.

2. Any objection to the Council taking measures to encourage the organizations represented on the Council to express their views on this matter direct to the Ottawa authorities.

The Institute's decision on this was also in the affirmative, inasmuch as the organization is represented on the National Construction Council and therefore is in a position to receive direct from its representative any recommendations from the Council along with his own personal comments thereon. The National Construction Council should do nothing "to encourage" its member organizations in determining the details of their policies.

3. If it holds the opinion that the Council should take no action whatever in this matter.

The Institute's answer to this is also in the affirmative. Many councillors expressed the opinion that the officers of the Wartime Prices and Trade Board were in the best position to know what action should be taken, keeping in mind at all times the broad general interest of the country rather than the specific interests of any particular groups.

It was unanimously resolved that Mr. W. E. Bonn, of Toronto, be asked to represent the Institute on the executive of the National Construction Council to replace the late Mr. D. C. Tennant.

Report of Special Committee on Professional Ethics: The general secretary reminded Council that about three years ago it had appointed a committee with Mr. F. H. Peters, of Ottawa, as chairman, to report on the Canons of Ethics proposed by the Engineers Council for Professional Development. Mr. Peters' committee had been scattered across Canada and negotiations had to be carried on by correspondence. He reported that under the circumstances it was difficult to handle the matter satisfactorily, but eventually a report was presented which indicated that the committee was not unanimous in accepting the proposed code as written.

Recently, E.C.P.D. has expressed the wish that the matter be considered again by those organizations which had not given approval. Apparently each of the eight constituent members, with the exception of the Institute and one other, had accepted the code in its entirety or with simple modifications.

In August Council appointed a further committee with all members located in the city of Toronto. This committee, of which Dr. Otto Holden is chairman, has now presented a communication from Dr. C. R. Young to the effect that he had seen the report and was well pleased with it. He recommended that Council accept it and refer it to E.C.P.D. This Council did unanimously.

Membership Committee: In addition to its annual report for the year, the Membership Committee submitted to Council a brief dealing with some of the probable requirements of branch membership committees resulting from the large growth of the Institute in the last few years. The main recommendation was that the Institute should issue a handbook or book of instructions for the use of branch membership committees.

The general secretary reported that for a long time he and Mr. Trudel had realized the need and had only been waiting for the time and opportunity to undertake the preparation of such a booklet. He would be glad to receive from Council instructions to proceed. Following some discussion, during which all members expressed approval of the suggestion, it was unanimously resolved that the recommendation of the Membership Committee be approved and that the general secretary be instructed to discuss the matter with the committee as soon as possible.

Statistical Control of Quality: The general secretary presented a letter from Councillor C. A. Peachey, who was unable to be at the meeting. In this Mr. Peachey pointed out that statistical control of quality was but one of several tools used by industry and he questioned the advisability of the Institute showing any special interest in this particular one when others were of equal importance. He was of the opinion, also, that there was considerable artificial stimulation in the publicity on this subject.

He pointed out that various organizations in the United States had recently established a central organization known as the American Society of Quality Control with which his company is in very close contact. He recommended that for the time being at least the Institute should not proceed with the organization of its committee. Through his company he would be closely in touch with developments in Canada and the United States and would advise

Council if subsequently it appeared that the Institute could render a service by establishing such a committee. Mr. Peachey's report was accepted unanimously.

Harry Bennett Educational Fund: Mr. Vance one of the trustees of the Harry Bennett Educational Fund, and chairman of the committee, reported that the funds already subscribed very closely approached the $25,000 which had been set as the objective. The campaign was to be continued until all the members and all the branches had been given further opportunities to contribute.

His report was of a preliminary nature but he expressed the hope that very shortly there would be a final report with an audited statement. At the same time he thought the three trustees, who were appointed temporarily, should resign so that Council could reconstitute the Board in the light of present conditions.

Mr. Armstrong pointed out that the trustees have not only been the committee which collected the money but they had also negotiated the difficult arrangements with Ottawa to obtain the tax free privilege. He thought Council should record its appreciation of the outstanding work done by the trustees and that their resignations should be accepted if they preferred to retire now.

Mr. Vincent supported Mr. Armstrong's expression of appreciation and he proposed that the minutes of this meeting record Council's enthusiastic reception of Mr. Vance's report. This was seconded by Mr. Lalonde and carried unanimously.

It was agreed that in view of the far-reaching possibilities of this fund, a publicity release should be prepared immediately.

Committee on Employment Conditions: In the absence of the chairman, the general secretary reported on behalf of the Committee on Employment Conditions. Mr. Heartz had asked Council to accept this report as incomplete, but he expected to have the final report for printing in their hands shortly.

The outstanding part of the report was that which referred to the Industrial Relations and Disputes Investigation Act 1947. Mr. Heartz' committee had met to consider a preliminary draft of the Act and at the same time considered opinions which had been submitted to it by members of the Institute who discussed the Act before their national bodies. The report pointed out that the new Act, in the definition of an employee, specifically mentioned professional work. This word was not included in Order-in-Council 1003 which the new Act was to replace.

Also, in Section 10 (1) the new Act provides that, " Where the majority of a group of employees of an employer who belong to a craft or profession, by reason of which they are distinguishable from the employees as a whole, are separately organized into one trade union pertaining to the craft or profession, if the group is otherwise appropriate as a unit for collective bargaining, the trade union may apply to the Board and shall be entitled to be certified as the bargaining agent of the employees in the group ". This is the first time professional workers were included specifically in such a clause.

The report stated that the committee was transmitting its opinions to the Minister of Labour in accordance with his request for comments and must repeat that because of the clear decision recorded by the Institute's questionnaire, the committee could still only support the proposal that collective bargaining for professional workers should be in the sole control of such workers. To include them with non-professional workers in any bargaining unit, as had been ordered in more than one case by the National War Labour Board, would be eventually to have the professional workers outvoted and quite possibly forced to transfer their collective bargaining affiliations to a trade union.

Council accepted the report and agreed with its recommendation that the Institute could not change the opinion expressed by the membership and agreed to by the Committee of Fourteen.

Joint Aeronautical Section: The general secretary reminded Council of the co-operative agreement which had been in force for some time between the Institute and the Royal Aeronautical Society. During the war the agreement had been dormant but there were now definite signs of renewed activity and interest. The Institute of Aeronautical Science, with Headquarters in New York, was becoming quite active in Canada, and had expressed an interest in a three-way agreement. A draft agreement was now being prepared for the consideration of the three bodies and he hoped to be able to submit this to Council for approval at an early meeting.

A.S.M.E. Semi-Annual Meeting: A letter was presented from the secretary of the American Society of Mechanical Engineers inviting the Institute to participate formally in a meeting on " passenger comfort " being planned by the Aviation Division for the Society's Semi-Annual Meeting to be held in Chicago in June 1947. It was unanimously resolved that the invitation be accepted.

American Institute of Mining and Metallurgical Engineers: A letter was presented from the American Institute of Mining and Metallurgical Engineers inviting the Institute to appoint an official delegate to the 75th Anniversary Celebration of the Founding of the Institute in 1871. The celebration will be held in New York City on March 17th, 18th and 19th, 1947.

It was unanimously resolved that the invitation be accepted and that the president be asked to represent the Institute, with the understanding that if he is unable to attend he will appoint another officer of the Institute to represent him.

Kelvin Medal: The general secretary presented a communication from the Kelvin Medal Award Committee inviting the Institute to make a recommendation for the 1947 award of the medal, such recommendation to be received in England before the first of June. The general secretary was instructed to make the necessary inquiries and submit suitable names for the consideration of Council.

Life Membership: It was noted that the following names had been added to the list of members upon whom, under the revised by-laws, Life Membership had been conferred as of January 1st, 1947: A. C. D. Blanchard, Montreal; Geo. Wm. Burpee, New York; Wm. Geo. H. Cam, Montreal; Douglas M. Chadwick, Montreal; Charles J. Chaplin, Almonte, Ont.; John G. Dickenson, Toronto; Llewellyn C. Jacobs, Montreal; Ibbotson Leonard, London, Ont.; James C. MacDonald, Victoria, B.C.; Wm. H. McGaan Montreal; Thos. A. McGinnis, Kingston, John H. McLaren, Montreal; Douglas L. McLean, Winnipeg; Kenneth R. McLennan, Toronto; Harold G. McVean, Toronto; Charles R. Murdock, Kapuskasing, Ont.; G. W. F. Ridout-Evans, Ottawa; J. F. Robertson, Copper Cliff, Ont.; Murray A. Stewart, Toronto; Stephen J. H. Waller, Quebec.

It was decided that the next meeting of Council would be held in Montreal on Saturday, February 15th, 1947. The March meeting will probably be held on the 15th of the month in Fredericton or Saint John during the president's tour of the maritime branches, but no decision has been reached on this as yet.

The Council rose at twelve-thirty p.m.

ELECTIONS AND TRANSFERS

Members

Ambrose, Howard George, B.A.Sc., (Mining Engrg.), Toronto, instrumentman, Canadian National Railways, London, Ont.

Anderson, Burrett Lyman, B.A.Sc., (Mech. Engrg.), Toronto, managing-director, Keith Tool & Production Co., Ltd., Cippenham, Bucks., England.

Barwick, William Stanley, consultg. engr., 1002 Hall Bldg., Vancouver, B.C.

Creighton, Hugh Herbert Lowry, B.Sc., (Elect. Engrg.), Alberta, A. D. Ross & Co., Ltd., Ste. Therese, Que.

Greason, James W., B.A.Sc., Toronto, designing engr., plant engrg. dept., Ford Motor Co. of Canada, Ltd., Windsor, Ont.

Heaps, John Morton, mech. engr., Consolidated Mining & Smelting Co. of Canada, Ltd., Trail, B.C.

Henderson, John Charles, B.A.Sc., Toronto, 717 Eglinton Ave., W., Toronto, Ont.

Mackenzie, Bruce Hugh, B.A.Sc., Toronto, development engr., Imperial Oil Limited, Sarnia, Ont.

Macpherson, Ian James, engineer, Howard Smith Paper Mills Limited, Cornwall, Ont.

Raney, Frederick Everett, Lt.-Col., Royal Canadian Signals, B.Sc., (Elect.), Queen's, Canadian Army Staff, Washington, D.C.

Ritchie, Frank Albert, B.Sc., (Mech.), Queen's, process and purchasing engr., machine engrg. dept., Ford Motor Co. of Canada, Windsor, Ont.

Rochester, Donald Harvey, Major, R.C.E., B.A.Sc., Toronto, Staff College of Canada, Royal Military College, Kingston, Ont.

Shopsowitz, David, B.A.Sc., (Elect.), Toronto, demonstrator, Univ. of Toronto, Toronto, Ont.

Svenningson, Freeman, Mech. Engr., Cornell Univ., designing dftsman., Shawinigan Engineering Co., Ltd., Montreal, Que.

Talbot, Louis Rene, Graduate, R.M.C.; B.Sc., (Civil), Queen's, president and genl. mgr., Rene Talbot Limited, Quebec City, Que.

Thomson, John Morton, B.A.Sc., M.A.Sc., Ph.D., Toronto, asst. genl. mgr., Ferranti Electric Limited, Toronto, Ont.

Wilson, Ralph Frederick, B.A.Sc., (Civil), Toronto, genl. supt. & personnel mgr., Donald Ropes & Wire Co., Ltd., Hamilton Ont.

Juniors

Barron, William Donald, B.Sc., (Mining), Queen's inspectr.. sprinklered risk dept., Canadian Underwriters Assoc., Montreal Que.

Damecour, Charles, B.Eng., (Mech.), McGill, 419 Belanger St., Montreal 10, Que.

Hunt, Thomas Richard, B.Sc., (Chem. Engrg.), Saskatchewan, asst. engr., British American Oil Refinery, Montreal East, Que.

Mens, John Roderick, B.A.Sc., (Mech.), Toronto, mech. engr., engrg. & mtce. dept., Canadian Kodak Co., Ltd., Toronto, Ont.

Tremayne, William Maurice, B.Sc., (Civil Engrg.), New Brunswick, structl, engr., Canadian Bridge Co., Windsor, Ont.

White, Herbert Brian, B.Sc., (Civil), Toronto, special lecturer, Univ. of Toronto, Ajax Division, Ajax, Ont.

Affiliate

Stevenson, Henry Frederick, B.Arch., Manitoba, asst. to chief engr., marketing dept., Imperial Oil Limited, Toronto, Ont.

Transferred from the class of Junior to that of Member

Bartlett, Ewart H., B.Eng., (Elect.), N.S. Tech. Coll., engr., Newfoundland Light & Power Co., St. John's, N'fld.

Blackett, Robert Leslie, B.Sc., (Chem.), Queen's, engr. i/c dfting. and engrg. office, Tropical Oil Co., Barranca Bermeja, Colombia, S.A.

Briceland, Emmett V., B.Sc., (Mech.), Queen's, managing engr., Elevator Specialty Co., Ltd., Toronto, Ont.

DeMaio, Alexander, B.A.Sc., (Mech.), Toronto, supt. of constrn. of main dam, Aguasabou, Hydro Electric Power Commission of Ontario, Schreiber, Ont.

Doehler, Rolf John, B.Eng., (Civil), McGill, asst. engr., Montreal Welding Co., Montreal, Que.

Fraser, Campbell, B.Sc., (Civil), Queen's, asst. divn. engr., Dept. Highways Ontario, Stratford, Ont.

Hopkins, Peter McMillan, Graduate, R.M.C., transformer and right of way divn., Quebec Hydro Electric Commission, Montreal, Que.

Nadeau, Leopold M., B.A.Sc., C.E., Ecole Polytechnique, asst. registrar, Corporation of Professional Engineers of Quebec, Montreal, Que.

Scott, Walter Barrett, B.Eng., (Civil), McGill, woods engr. and party chief, woods engrg. dept., Quebec North Shore Paper Co., Baie Comeau, Que.

Steiman, Morris Irvin, B.Sc., (Civil), Manitoba, technical reconstrn. officer, Public Works of Canada, Winnipeg, Man.

Woodhall, Thomas Latimer, B.Sc., (Elect.), M.Sc., Manitoba elect. & design engr. & asst. chief engr., Manitoba Power Commission, Winnipeg, Man.

Admitted as Students

Students at University of Toronto

F. K. Dumbrille	M. C. Nadas
S. W. Forstrom	S. A. W. Otton
V. C. German	D. Pearson
E. W. Hill	J. G. Taylor
R. Isles	P. L. J. Tillson
M. C. Kupisz	R. A. Westman
S. Z. Mack	W. M. Young
A. Makerewick	

Students at McGill University

J. W. Clarke	G. A. Robb
K. H. Cram	J. W. Saunders

Students at University of Alberta

H. G. Clark	W. W. Ryan
G. Hodge	H. B. Scott
C. McConnell	

Students at University of New Brunswick

W. N. Brown	G. M. Howard
F. C. Dohaney	

Student at Queen's University

W. H. Millar

Student at University of Manitoba

I. G. Duncan

Student at Nova Scotia Technical College

J. C. Manning

By virtue of the co-operative agreements between the Institute and the associations of professional engineers, the following elections and transfers have become effective:

Alberta

Member

Menzies, Dudley Blair, B.Sc., (Civil), Alberta; M.Sc., Harvard, City Commissioner, City of Edmonton, Alberta.

Saskatchewan

Student

Hoskin, Douglas George, Univ., of Saskatchewan, Saskatoon, Sask.

Nova Scotia

Junior to Member

Dumaresq, James Philip, B.Eng., Nova Scotia Tech. College; M.Sc., (Civil Engrg.), Massachusetts Institute of Technology, design engr., Canadian Gypsum Co., Ltd., Windsor, N.S.

Quebec

Members

Kunstler, Peter Justin, Mech. Engr., Bodenbach Tech. Coll., Czechoslovakia, mech. engr., Canadian Industries Ltd., Montreal, Que.

Legault, Gedeon E., B.A.Sc., C.E., Ecole Polytechnique, divn. engr., Dept. of Roads, St. Henri, Levis Co. Que.

Macé, J. Maurice, B.Eng., McGill, mgr., rural electrification dept., Northern Electric Co., Ltd., Montreal, Que.

Norsworthy, Edward Cuthbert Villiers, B.Eng., (Mech.), McGill, project engr., conversion plant, Canadair Ltd., Montreal, Que.

Stoddart, Thomas William Hartley, B.A.Sc., Toronto, development engr., Northern Electric Co., Ltd., Montreal, Que.

Junior to Member

Cameron, Adam Kirkland, B.Eng., (Mech.), McGill, industrial engr., Canadian Industries Limited, Montreal, Que.

Personals

News of the Personal Activities of members of the Institute

H. A. McKay, M.E.I.C., is the newly-elected chairman of the London Branch of the Institute. He was born at Seaforth, Ont., and studied at Toronto University, receiving a B.A. Sc. degree in 1923. He was first employed by the Disher Steel Construction Company Limited, Toronto, as a draughtsman and engineer, and he went to Sutcliffe & Company at New Liskeard in 1924. He entered the London Structural Steel Company Limited in 1925, and in 1928 he was vice-president and manager, with charge of design, sales, production and erection work. From 1940 he served for over four years with the R.C.E. He was with the directorate of works and construction in Ottawa, and later with the directorate of accomodation and fire prevention at National Defence Headquarters. He was promoted to the rank of colonel and awarded the O.B.E. He is now president and engineer of McKay-Cocker Construction Limited, London, Ont.

J. M. Crawford, M.E.I.C., is chairman of the Montreal Branch of the Institute for 1947. He was born at Howick, Que., and holds a B. Sc. and a master of engineering degree from McGill University, Montreal, the latter received in 1932. He demonstrated in the electrical engineering department of the university during the 1929-30 session, and then entered the Shawinigan Water and Power Company, Montreal, as an electrical engineer. He is now assistant superintendent of the engineering division of the company.

F. F. Dyer, M.E.I.C., Imperial Oil Limited engineer, is the newly-elected chairman of the Sarnia Branch of the Institute. He was born at Toronto, Ont., and studied at Toronto University, receiving a B.A.Sc. degree in 1931. On graduation, he joined the Turnbull Elevator Company, Toronto, where he was employed on design and draughting, and he worked in 1932 as factory superintendent for Cutting Limited, Toronto. He joined the faculty of his University that year, and for three terms he was demonstrator in hydraulics. He entered Imperial Oil Limited in 1934, and was first employed on boiler and meter tests in the combustion department. He transferred in 1937 to the general engineering department.

E. C. O'Leary, M.E.I.C., has been elected chairman of the Halifax Branch of the Institute. Born in Halifax, he attended the Nova Scotia Technical College, receiving a B.A.Sc. degree in civil engineering in 1936. He went to the Standard Paving Company Halifax, after graduation, remaining until 1944 and holding various positions. He was in charge of phases of highway construction and paving and preliminary investigations preparatory to tendering on highway projects for several years, and became field superintendent in charge of construction in 1939. He went as operating engineer to the Public Service Commission of Halifax, N.S., in 1944.

Major-General G. R. Turner, M.E.I.C., the newly-elected chairman of the Ottawa Branch of the Institute, was born at Four Falls, N.B., and was educated in that province. He was engaged on railway construction for several years and enlisted in the Engineers at the outbreak of war in August, 1914. He was commissioned in 1915, and promoted to the rank of captain a year later. Appointments in regimental and staff services followed, and he received his majority in 1918. He was mentioned in dispatches and awarded the Distinguished Conduct Medal and the Military Cross and bar. In 1920 he was appointed to the R.C.E. (Permanent Force) with the rank of captain, and attended the School of Military Engineering, Chatham, England, for two years. Returning to Canada, he became instructor in military engineering at Royal Military College, Kingston. He later attended the Staff College at Quetta, India, for two years, and in 1927 was appointed district engineer officer at Winnipeg, Man. Two years later he was made Assistant Director of Engineer Services, National Defence Headquarters, Ottawa, with the rank of major, and from 1933 to 1937 he served in the General Staff and M.G.O. Branches at N.D.H.Q., Ottawa, with the rank of lieutenant-colonel. In 1938 he attended the Imperial Defence College, London, England, for a year and on his return was appointed General Staff Officer, grade 1, at M.D. No. 11, Victoria, B.C. His service also included periods of duty at Halifax, Saint John, N.B., Quebec, and Toronto, on Engineer Works.

At the outbreak of World War II he went overseas as General Staff Officer, grade 1, with the 1st Division. On formation of the Canadian Corps in 1940, he was appointed deputy adjutant and quartermaster general of the corps with the rank of brigadier, and on formation of the First Canadian Army in 1942 he received a similar appointment there with the rank of major-general. He was made a Companion of the Most Honorable Order of the Bath in 1943. Returning from overseas service in 1944, he was loaned for several months to the Department of Veterans Affairs as Special Assistant to the Deputy Minister for work on accommodation projects. In 1945 he was made Inspector General of the Army in Western Canada with headquarters in Calgary and, having reached the age limit for service in the postwar Army, was retired in 1946.

F. F. Walsh, M.E.I.C., has been appointed secretary-treasurer of the Sarnia Branch of the Institute. He was born in Toronto, and studied at Toronto University, graduating with a B.A.Sc. in mechanical engineering in 1940. He went to the Steel Company of Canada, Hamilton, that year and in 1943 to the St. Clair Processing Corporation, Limited, Sarnia, Ont., as technical supervisor in the steam and power plant. He transferred to the Polymer Corporation Limited at Sarnia, in 1946, where he is employed as plant utility engineer.

Arthur Surveyer, M.E.I.C., **Emil Nenniger,** M.E.I.C., and **J. G. Chênevert,** M.E.I.C., consulting engineers of Montreal, and partners for a number of years under the firm name of Arthur Surveyer and Company, have recently renewed their partnership contract under the firm name of Surveyer, Nenniger and Chênevert.

Dr. Charles Camsell, M.E.I.C., has been elected to the presidency of the Canadian Institute of Mining and Metallurgy. A recipient of the Engineering Institute's Julian C. Smith medal for 1946, and recently retired from a twenty-five year tenure as Dominion Deputy Minister of Mines and Resources, Dr. Camsell was vice-president of the C.I.M.M. in 1921-22.

D. B. Carswell, M.E.I.C., marine consultant, Montreal, recently became the first Canadian elected a fellow of the Society of Consulting Marine Engineers and Ship Surveyors, London, England. After long association with marine affairs in Canada, he was called to the War Supply Board in 1939 as director of shipbuilding, and was appointed director general of shipbuilding on the formation of the Department of Munitions and Supply. Made controller of ship repairs and ship salvage in 1941, with headquarters in Montreal, he became president of Wartime Shipbuilding Limited in Montreal in 1945.

Dr. de Gaspé Beaubien, M.E.I.C., Montreal consulting engineer and past-president of the Institute, has been elected president of the Royal Automobile Club of Canada. He has served the Club as vice-president, and has taken an active interest in highway safety problems.

John H. T. Morrison, M.I.E.C., of Campbellton, N.B., district highway engineer for the Department of Public Works of New Brunswick, was elected president of the Association of Professional Engineers of New Brunswick, at the annual meeting held at Saint John, N.B.

Aimé Cousineau, M.E.I.C., director of city planning of the City of Montreal was presented with the honorary degree of doctor of applied science by the University of Montreal, at the annual general meeting of the Graduates Association of Ecole Polytechnique on February 8th. Mr. Cousineau is a graduate of Ecole Polytechnique, of the Massachusetts Institute of Technology and of Harvard University.

Huet Massue, M.E.I.C., of the Shawinigan Water and Power Company, Montreal, received the honorary degree of doctor of applied science from the University of Montreal, at the annual general meeting of the graduates of Ecole Polytechnique on February 8th. He is a graduate of Ecole Polytechnique and the Massachusetts Institute of Technology.

A. B. Cooper, M.E.I.C., president of Ferranti Electric Limited, Toronto, recently retired as general manager of the company. He has been with Ferranti since 1922, when he became general manager, coming from the Canadian General Electric Company Limited in Toronto. He is a past-president of the Association of Professional Engineers of Ontario, a past vice-president of the American Institute of Electrical Engineers, and has been on the executive council for Ontario of the Canadian Manufacturers' Association.

Dr. J. M. Thomson, M.E.I.C., has been appointed general manager of Ferranti Electric Limited, Toronto, to succeed Mr. Cooper. He became associated with Ferranti Electric in 1926 as a radio engineer, since which time he has held various positions in engineering design and development. He became chief designing engineer in 1937 and chief engineer in 1942. He was assistant general manager for the company prior to his recent appointment. He is an Associate Member of the British Institution of Electrical Engineers, and a member and past vice-president of the American Institute of Electrical Engineers.

W. Raywood Smith, M.E.I.C., who recently resigned as county engineer for Middlesex County, Ont., was appointed in January as special consultant to the Ontario Department of Planning and Development. He will act as an advisory engineer between the department and municipal bodies in the Thames River Valley, which has been surveyed for extensive flood control and conservation development.

Albert Deschamps, M.E.I.C., Montreal contractor and engineer, was re-elected president of the Canadian Construction Association at its twenty-ninth annual meeting at Niagara Falls, Ont., on January 16th. **Allan C. Ross,** M.E.I.C., president of Ross and Meagher Limited, Ottawa, was re-elected as first vice-president. Regional vice-president for Quebec is **P. N. Gross,** M.E.I.C., of Montreal, president of the Anglin-Norcross Corporation Limited. **Norman Eager,** M.E.I.C., is the new chairman of the manufacturers and supply dealers section. He is general manager of the Burlington Steel Company Limited, Hamilton, Ont. Re-elected as chairman of the general contractors section is **Tullis N. Carter,** M.E.I.C., vice-president and chief engineer of the Carter Construction Company Limited, Toronto, and the vice-chairman of this section is **C. Howard Gordon,** M.E.I.C., of Montreal, vice-president and managing director of the Atlas Construction Company Limited.

J. N. Langelier, M.E.I.C., chief engineer of the Metropolitan Commission of Montreal was elected president of the Graduates Association of Ecole Polytechnique, Montreal, at its recent annual meeting. He is a B.A.Sc. in civil engineering of the class of 1910.

S. A. Charters, M.E.I.C., of Westeel Products Limited, now represents the company in Ottawa, Ont. He transferred from his position as sales engineer in the Montreal office in January 1947. A graduate of McGill University, he spent six years with Watson Jack and Company, Montreal, as sales engineer, and served three years with the R.C.A. Discharged with the rank of captain, he joined Westeel in 1946.

P. W. Geldard, M.E.I.C., has been appointed engineer of distribution of the Consumers' Gas Company of Toronto. He joined the company as a cadet engineer in 1929, on graduation from the University of Toronto. A year later he was general foreman, and he received subsequent appointments as district superintendent in 1931, superintendent of the street department in 1935, and assistant engineer of distribution in 1939.

S. G. Naish, M.E.I.C., has been appointed to the position of manager of mining sales for the maritime provinces for Canadian Sullivan Machinery Company Limited, with office located at Sydney, N.S. He was formerly eastern district manager for Peacock Brothers Limited, Sydney. He is secretary-treasurer of the Cape Breton Branch of the Institute and secretary of the Eastern Section of the Coal Division of the Canadian Institute of Mining and Metallurgy.

H. S. Petford, M.E.I.C., is now at the head office of National Breweries Limited, Montreal, as assistant director of engineering. He was formerly at the company's Dawes Black Horse Brewery, Montreal, where he was manager since 1943.

J. W. Reside, M.E.I.C., recently accepted a position as industrial engineer with the Department of Industry and Publicity of Nova Scotia at Halifax. He had been with the Department of Highways at Yarmouth, N.S.

F. G. Rounthwaite, M.E.I.C., has been appointed president of the newly formed import-export firm of Drake Gardner (Canada) Limited, Montreal. He served with the Department of Munitions and Supply of the Canadian Government at Washington as director of procurement, and later as president of War Supplies Limited.

Lt.-Colonel S. Stephenson, M.E.I.C., who has been in Austria with the Royal Engineers as technical staff officer engaged on British Intelligence objective survey of instrument targets, is back in England. He is in the research and development section of the staff of the director general of artillery.

F. S. Stratton, M.E.I.C., is now Canadian engineering representative for the Copperweld Steel International Company, of New York. He is located at Toronto. A graduate in electrical engineering of the University of Manitoba, he has been associated with the Winnipeg Electric Company and the Montreal Light, Heat and Power Company. Prior to his recent appointment, he was with the Exide Battery Company of Canada Limited, Toronto, as a sales engineer.

T. F. Rahilly, M.E.I.C., has been elected chairman of the Sault Ste. Marie Branch, of the Institute. He was born in that city, and studied at Queen's University, Kingston, Ont., receiving a B. Sc. in mechanical engineering in 1939. That year he entered the Algoma Steel Corporation Limited in Sault Ste. Marie. He was assistant master mechanic in the blast furnace department in 1939, and was promoted to master mechanic the following year. He is now assistant superintendent of the mechanical department of the company.

Robert Griesbach, JR.E.I.C., the new chairman of the Junior Section of the Montreal Branch of the Institute is a designing engineer with Surveyer, Nenniger and Chênevert, consulting engineers, Montreal. He is a graduate of McGill University, Montreal, class of 1942, with the degree of bachelor of engineering.

Obituaries

The sympathy of the Institute is extended to the relatives of those whose passing is recorded here.

Louis Raymond Gransaull, M.E.I.C., of St. Joseph, Trinidad, B.W.I., passed away on June 27th, 1946, in New York City. He was born in St. Joseph in 1883, and graduated as a sworn surveyor from St. Mary's colleger there. He was first employed as assistant on the trigonometrical survey of Trinidad in 1904.

Coming to Canada the next year, he spent several years on railway engineering projects at Montreal, Shawinigan Falls, Three Rivers, Que., Fort William, Ont., North Battleford, Sask.. Brandon, Man., and Wainwright, Alta., undertaken by the St. Maurice Valley Railway, the Grand Trunk Pacific Railway or the Canadian Pacific Railway. He returned to Trinidad in 1915, where he was assistant engineer for Trinidad Leaseholds, Limited, at Pointe-à-Pierre. He was later connected with engineering for the Siparia Railway Extension in St. Joseph, with Engineering Contractors and Manufacturers, Port of Spain, and with the Palo Seco Oilfields. He had a consulting practice in Port of Spain in 1926 and has practised as a land surveyor in St. Joseph since 1927. He has also been successful as a lime grower and producer of lime oil.

Mr. Gransaull joined the Institute in 1905 as a Student, transferring to Associate Member in 1911 and to Member in 1940.

Claude Vernon Johnson, M.E.I.C., died in Quebec on January 27th, 1947. He was born in Ottawa, Ont., in 1881 and commenced his engineering career with five years duty as rodman, instrumentman or draughtsman on location and construction of the Canadian Northern Railway, the Grand Trunk Pacific Railway and the National Transcontinental Railway. With the last mentioned, in 1908, he became assistant engineer and assistant office engineer in charge of headquarters general draughting staff at Ottawa, remaining until 1913 when he went to Quebec, as engineer in charge of construction for Jos. Gosselin Limited, general contractors. Here he was responsible for the construction of plants, railways, bridges and buildings in the province of Quebec. In 1918 he went to the Foundation Company in Montreal, returning later to Quebec where for many years he carried on a consulting engineering practice. In 1946 he was appointed technical writer and translator for the Department of Roads of Quebec. Mr. Johnson was the author of two books, "A Travers le Temps et l'Espace" and "Le Pendule Mysterieux."

He joined the Institute as a Student in 1907, transferring to Associate Member in 1910, and to Member in 1918. Life Membership was awarded to him on January 1st this year.

Homer Lindsay Currie, M.E.I.C., of the Canadian National Railways, died on January 2nd, after an association of nearly a quarter of a century with C.N.R. in various sections of eastern and western Canada. He was born in Woodstock, N.B., in 1892, and studied at the University of New Brunswick, graduating with a B.Sc. degree in 1913. He began his railway service in the same year, when he joined the Canadian Government Railways at Moncton as a leveller. He became a draughtsman in 1915 and in the following year enlisted with the C.E.F. He returned to the railway, serving successively at Moncton, Fort William, St. Catharines, Montreal and Halifax until 1925, when he was promoted to resident engineer at Toronto. Moving to Montreal in 1927, he held the posts of supervisor of buildings, engineer, grade separations, before his appointment as office engineer in 1943.

Among the large C.N.R. construction projects of which he had charge were the construction of the terminal at Neebing, Ont. in 1922-24; engine and car yard facilities at the Toronto terminals in 1926-27; the locomotive erection shops at Montreal in 1928; and many problems connected with the new Montreal terminal plan between 1929 and 1943. He directed war emergency track requirements for the C.N.R. system.

Mr. Currie was interested in photography as a hobby, and he made fine furniture and violins. He studied astronomy, and had made a telescope.

He joined the Institute as an Associate Member in 1921, transferring to Member in 1940.

Herbert A. Ricker, M.E.I.C., of Hamilton, Ont., passed away at his home on December 30th, 1946. Ill health had forced him to end his career in engineering with the Canadian Westinghouse Company in Hamilton in 1938, when he was chief draughtsman. He had formerly been mechanical engineer. In that capacity he had been responsible for the mechanical design of many large alternating current machines. These included vertical generators for hydro-electric power stations in Quebec on the Saguenay River, in Nova Scotia, in British Columbia, at Chats Falls on the Ottawa River, at Beauharnois, Que., at Queenston on the Niagara River, and many other stations. During his association with the company some unusual designs were evolved, which included the 25,000 kva., 25 cycle, 500 rpm., synchronous condensers which are now installed at Leaside in Ontario and the 45,000 kva, 300 rpm. 25 to 60 cycle frequency changers which are installed at Chats Falls and Masson.

Mr. Ricker was born at Dunnville, Ont., in 1882. He studied at Dunnville and Caledonia, returning to teach in the public schools near Dunnville. Later he went to western Canada to teach in Saskatchewan, returned to enter the University of Toronto, and graduated in mechanical and electrical engineering in 1910 with a B.A.Sc. degree. He entered Canadian Westinghouse Company in Hamilton that year. Starting as a draughtsman, he later became mechanical engineer on a/c generator design.

He joined the Institute as a Member in 1928.

A. G. Fleming, M.E.I.C., of Montreal, died on January 8th 1947, after a few days illness. Born at Craigleith, Ont., in 1882, he attended Queen's University, Kingston, Ont., graduating in 1904 with a B.A. degree. He later attended the School of Mines at Queen's. He was employed by the Exshaw Portland Cement Company at Exshaw, Alta., and by the International Cement Company at Hull, Que. When the Canada Cement Company was formed in 1909 he became chemist at the Hull plant. In 1913 he became chief chemist in Montreal, in which position he continued until his death. Possibly his outstanding research work was in connection with the deterioration of concrete in alkali soils. In 1932 he developed a special cement, Kalicrete, which has been of great value to the construction industry particularly in western Canada. He received the Plummer Medal of the Engineering Institute in 1933 for his paper on "The Development of Special Portland Cements in Canada". He had an important part in the organization of the Chemical Societies in Canada. He was consulting chemist to the Campanhia Brasileira de Cimento Portland Perus at Sao Bralo, Brazil.

Mr. Fleming joined the Institute in 1928 as a Member.

William S. Fraser, M.E.I.C., district engineer for the Canadian Westinghouse Company Limited at Calgary, died suddenly on December 1st, 1946, at his home in Calgary.

He was born in Hamiota, Man., in 1895, and graduated from the University of Manitoba with the degree of B.Sc. in electrical engineering in 1922. After graduation he joined the Westinghouse test course at Hamilton, Ont. He was assistant district engineer at Winnipeg from 1923 to 1925, service engineer at Fort William, Ont., from 1925 to 1929, and district engineer at Calgary from 1929 until the time of his death.

He became an Associate Member of the Engineering Institute in 1939, transferring to Member the next year. He was also a member of the Association of Professional Engineers of Alberta, and of the Electrical Engineers Association.

News of the Branches

Activities of the Twenty-eight Branches of the Institute and abstracts of papers presented

EDMONTON BRANCH

W. W. Preston, Jr.E.I.C. - *Secretary-Treasurer*

A brighter future for Alberta in agriculture and industry, to be made possible by proposed programmes of water reclamation, was foreseen by John R. MacNicol, of Toronto, when he addressed the Edmonton Branch on January 10th, 1947, at a dinner meeting in Merrick's Embassy Room. Mr. MacNicol, who has recently taken pictures of irrigation projects in the Platte river basin, in Nebraska, Wyoming and Colorado, showed coloured slides of prosperous sites which had been arid before irrigation. He envisioned similar improvements on our prairies.

The speaker claimed that the western provinces have failed to conserve water, and consequently 180 acres of prairie are required to produce what one acre of irrigated land can produce. He outlined the progress being made on the St. Mary's and Bow River projects and discussed plans for damming the South Saskatchewan River.

The magnitude of the irrigation programme developed by the U.S. Bureau of Reclamation in the Platte river basin was clearly shown by photographs of various canals, dams, tunnels, siphons and power houses. Other slides showed thriving cities which had sprung up near alfalfa plants, dehydrating plants, bean factories and other industries. With irrigation came hydro-electric systems and electricity on the farms.

In conclusion, Mr. MacNicol urged his audience to support the P.F.R.A. enthusiastically. He predicted that their efforts would double the population of western cities and bring several sugar beet, canning and other factories to Alberta. He claimed that prosperity in the west would mean prosperity for all of Canada.

Chairman of the meeting, which was attended by 69 members and guests, was J. W. Porteous. Mr. MacNicol was introduced by Mr. C. Garnett, and a unanimously supported vote of thanks was proposed by Ben Russell.

HAMILTON BRANCH

L. C. Sentance, M.E.I.C. - - *Secretary-Treasurer*
I. M. Macdonald, Jr.E.I.C. - *Branch News Editor*

The Hamilton Branch of the Institute held its annual meeting and dinner on January 9th, 1947, at the Scottish Rite Cathedral, with 85 members and guests attending. Chairman A. R. Hannaford presided.

Mr. E. T. Sterne, the guest speaker, was introduced by G. H. Richards as the manager of G. F. Sterne & Sons, Brantford. Mr. Sterne served on the Imperial Munitions Board during World War I, and during World War II was director of explosives, Allied War Supplies, and controller of chemicals, Department of Munitions & Supply. Mr. Richards described some of the speaker's many activities in his profession and in public life, and indicated that Mr. Sterne was well qualified to speak on **John Q. Engineer-Citizen.**

The engineering profession, by virtue of training and insistence on straight thinking on the part of its members, has a great responsibility to the future of this or any country. The engineer must expand his citizenship duties, and make use of his particular talents. The greatest function to be performed by the engineer is the function of service, maintained Mr. Sterne. Engineers must give their leadership, or else they will not achieve the type of management, both civic and industrial, that they know is best.

At the conclusion of Mr. Sterne's talk, H. A. Cooch expressed the thanks of the meeting to the speaker. Mr. Hannaford then handed the gavel of office to the new chairman, who closed the meeting after a few remarks.

LETHBRIDGE BRANCH

H. T. Miard, m.e.i.c. - - *Secretary-Treasurer*
E. A. Lawrence, s.e.i.c. - *Branch News Editor*

Forty-nine members and guests of the Lethbridge Branch of the Institute, attended a supper meeting in the Marquis Hotel, Saturday, January 18th, to hear W. L. Foss, supervising construction engineer in charge of the St. Mary's River Development, discuss the St. Mary's Dam. Chairman R. S. Lawrence presided.

Guests from district points were introduced by the chairman, and G. S. Brown introduced the speaker.

Mr. Foss paid tribute to local irrigation engineers for their intense interest in this major project. By use of a map he showed how waters of the Waterton, and Belly Rivers could be brought across country by canal to the St. Mary's River and the flood waters of these three rivers impounded behind the large St. Mary's River dam at Spring Coulee, thence diverted by canal to storage reservoirs along the Milk River ridge. This storage will not only assure existing irrigation projects of a steady supply of water but will make it possible to increase the present irrigable area to around 465,000 acres. This is only a portion of what could be irrigated if more water was available.

Several problems beset engineers in choice of a dam site. Among these were: the steep slope of St. Mary's River, 10 to 15 ft. per mile, running in a deep narrow basin, making adequate storage a problem; the location with regard to getting the maximum of stored water into an outlet canal; entrance of waters from the Belly and Waterton Rivers, which will eventually have to come in above the dam site; suitable foundations for dam, and availability of material i.e. fill, gravel, etc. Several types of dam were considered, and it was finally decided to construct an earth fill dam as best suiting the conditions.

A site was finally chosen near Spring Coulee with a capacity of 290,000 acres. At this point the rock, i.e. sandstone and shale with a high compressive strength, rises well above water level on either side of the river, and lies below the bed of the river to a depth of approximately 1,000 ft.

The dam will be earth fill construction about 2,600 ft. long and 30 ft. wide at the top, and will rise 186 ft. above the river bed. It will require about 3,250,000 cu. yd. of glacial till, i.e. clay formation, and 900,000 cu. yd. of gravel, both materials being available near the site. The speaker stressed the importance of getting the necessary moisture content in the fill material and compacting it in the dam in order to get a high density in the clay particles and a bond which would be impervious to water. The upstream side of the dam will be protected by a heavy blanket of gravel. The downstream side will be protected with a sand and gravel filter which will take care of any seepage through the dam and keep the back of the dam dry. The toe will be protected by rock rip-rap.

During construction of the dam the flow of the river will be diverted by a coffer-dam, 35 ft. high, into a circular diversion tunnel 20 ft. in dia. which is at present under construction and is designed to handle the maximum flood stage of the river.

The irrigation tunnel carrying water from the reservoir will exit 86 ft. above the river bed, has a horse-shoe shape and is 17 ft. in dia., designed to carry 3,200 cu. ft. per sec. Four hyraulically operated headgates will control the flow of water through this tunnel.

The spillway will be designed to take care of any large floods which may occur in the future. With only 40 years of records available and a very erratic weatherman holding sway over a drainage area of 830 sq. mi., this constitutes a problem for engineers who are building for the next 300 or 400 years.

Mr. Foss said that shortage of material was proving a handicap, but satisfactory progress was being made at the present time.

R. M. Stanley, on behalf of the branch, moved a hearty vote of thanks to Mr. Foss for his interesting address.

LONDON BRANCH

A. L. Furanna, m.e.i.c. - - *Secretary-Treasurer*
G. N. Scroggie, m.e.i.c. - - - *Branch News Editor*

On the evening of the 29th January, 1947, the London Branch held its annual meeting in the Hotel London with 60 members and guests attending. Before the dinner, refreshments were served and the assembled company had the opportunity of meeting and talking with acquaintances, old and new.

In the absence of Chairman J. H. Johnson, Vice-chairman H. A. McKay presided. After welcoming all guests and representatives of other societies, he announced the election of V. A. McKillop to succed J. A. Vance as councillor. The latter, who has been a councillor since 1933, spoke briefly, referring to the growth of the Institute, his work with the E.C.P.D., and with the Harry F. Bennett Educational Fund. Mr. Buchanan spoke on the progress of the Fund, saying that it was nearing its objective of $25,000, and that the London Branch had subscribed 250 per cent of their objective, to head all the Branches. He made special reference to the response from young graduates, and said that already two applications had been received for loans from the Fund.

Mr. McKay then introduced the speaker of the evening, Dr. Gordon H. Turner of the Department of Psychology of the University of Western Ontario. Dr. Turner, himself a graduate of Toronto, was greeted by an S.P.S. yell led by S. W. Archibald. Having served at C.M.H.Q., London, England, in World War II, the speaker was no stranger to several engineer officers present.

Human Relations was the subject of Dr. Turner's address, in which he said: "Wherever we go or whatever we do, we are dealing with people, and how we get along with these people greatly determines our success in life, whether the relations be family, social or business".

Expediency governs our conduct towards our employers or other people who are in a position to do something for us, the speaker explained, but our attitude governs our conduct towards other than these. "We do not mind looking up to people, but we dislike anyone looking down upon us", said Dr. Turner. The superior attitude held by some people is the answer to such questions as: Why are some people hard to like? Why do they engender hostile feelings in their fellow men? Why are their dealings unsuccessful? This feeling of superiority is manifested by lack of respect, sarcasm, criticism with anger, orders given in an officious manner, and aloofness. "It is not so much what we say as how we say it", said Dr. Turner. The cause for this superior attitude is either a sincere belief in one's superiority, or a lack of confidence and a fear of one's weaknesses being discovered. The solution for the latter is a complete knowledge of one's work, which will develop confidence.

W. J. Bright thanked the speaker on behalf of a very attentive audience for a very interesting address.

Mr. McKay then announced that Colonel I. Leonard and C. V. Corless had been awarded Life Membership in the Institute. A. L. Furanna gave a financial report and stated that the Branch membership was 102. The councillor-elect, Mr. McKillop, announced the results of the recent elections.

MONTREAL BRANCH

E. M. Van Koughnet, m.e.i.c. - *Secretary-Treasurer*
Hyman Schwartz, s.e.i.c. - - - } *Branch News Editors*
Eli L. Ilovitch, s.e.i.c. - - - - }

An engineer deals primarily with the proper utilization of materials. He studies their properties, analyzes their behaviour under various conditions, determines their cost, and then, weighing everything, reaches a decision on their use. Yet, although engineering schools recognize the importance of teaching the properties of materials and stress analysis, they have, by and large, neglected two important phases of the work, namely proper fabrication of the materials and proper co-ordination of the human element that must enter into their construction.

Only a small proportion of engineers stay in the purely technical field. Most of them ultimately graduate to supervisory and administrative positions. Many enter the selling field. A fair proportion end up by owning their own businesses.

On Thursday night, January 23rd, 1947, Professor D. B. Porter of New York University discussed the latter two phases of the engineer's work under the title **Education for Industrial Engineers.** He pointed out that it has been only within the past few years that schools have awakened to the fact that industrial engineering, factory management and factory relations are equally as important as the properties of materials. In fact, Canadian schools have sadly neglected this field and are far behind the United States.

Although industrial engineers as a distinct group within the engineering profession do exist, Professor Porter entered a strong plea for the recognition of the vital importance of industrial engineering education for engineers. "I have frequently had Commerce graduates come to me and ask if they could take post-graduate study work in industrial engineering," stated Professor Porter, "and I have had to explain to them that an industrial engineer is primarily an engineer".

Professor R. De L. French, who chaired the meeting, added that he had at all times attempted to impress upon the students the vital necessity of clear thinking and clear expression, an attribute which, unfortunately, many engineers appear to consider as unnecessary to the practice of their profession. Yet engineers must submit reports and propositions to non-technical people, must discuss plans with men who are not engineers, must understand how to convey their ideas to the other fellow. The ability to express oneself clearly, both orally and in writing, is a vital asset to an engineer.

OTTAWA BRANCH

C. G. Biesenthal, jr.e.i.c. - *Secretary-Treasurer*
R. C. Purser, m.e.i.c. - - - *Branch News Editor*

At the last noon luncheon of the calendar year, held on December 19, the programme portion of the meeting was given over entirely to the showing of a sound film, "Clean Waters". This film, provided through the courtesy of the Canadian General Electric Company, vividly demonstrated the dangers from polluted waters to public health, fish life, property values and recreation areas.

Although the film was entirely based on United States conditions, its lessons could well be applied to Canada with equal or even greater force. Almost $100,000,000 is lost annually in the United States through the lack of sewage disposal facilities. Clean water, man's greatest friend, not only enhances the claim of properties, but is also essential to the maintenance of public health, the preservation of marine and wild life, the existence of commercial enterprises and the operation of proper irrigation methods.

"We make open sewers of many of our waterways," the commentator said, "waterways from which 75 per cent of the communities in the United States get their water supply."

The annual loss would almost cover the cost of constructing the required 10,500 sewage disposal plants in the United States and would help to supply essential modern equipment to many of the 6,000 plants at present in operation. The film illustrated the operation of such plants.

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At the Annual Branch Meeting, held at the auditorium of the National Research Council Laboratories on the evening of January 8th, the chairman and executive of the branch for the ensuing year were elected.

Mr. Biesenthal presented the financial report for 1946, J. L. Shearer reported on the Membership Committee and L. M. Christmas on the Proceedings Committee. J. H. Irvine, retiring chairman, gave a brief review of the work of the Institute for the past year. The members decided that the usual grants made to technical schools in Ottawa and Hull for prizes to outstanding students would be continued in 1947. At the same time, it was recommended that Carleton College and Ottawa University should be included in this plan. Congratulations were extended to John J. Murphy, a corporate member for 57 years, on being appointed a life member.

Following the business meeting, three films were shown: "Transfer of Power", "The New North", and "Photo Canada". The first dealt with the progress of power from early times to the present, the second mainly with the Alaska Highway, and the last-mentioned with aerial mapping.

Refreshments were served.

PETERBOROUGH BRANCH

A. R. Hailey, m.e.i.c. - *Secretary-Treasurer*
J. C. Allan, m.e.i.c. - *Branch News Editor*

Dr. Herbert Moore of Stevenson & Kellogg Ltd., delivered a paper before the Peterborough Branch on **Management Engineering** on the evening of December 12, 1946.

Dr. Moore stated that management engineering could hardly have a concise and limited definition, but that he proposed to discuss such phases as job and salary evaluation, time study and methods, cost control, and personnel.

The speaker stated that studies made in many manufacturing establishments indicated that the effectiveness of engineers depended to the extent of 60% upon their personalities and their manner of selling their results and conclusions to the rest of the organization and only 40% upon the quality of the work itself.

Furthermore, due to a widespread defect in engineering education, such technical men are commonly less effective from the psychological or personality aspect than from the purely technical one. Some universities have undertaken to correct this situation by strengthening their engineering courses by the inclusion of more cultural subjects such as economics, history, social sciences, and English.

Dr. Moore discussed the personal characteristics required by various engineering positions, and contrasted the aptitudes required in a good research technician with those of a good supervisor. He also deplored the absence of opportunities for research men in Canadian industry.

Potential technicians should be about 30% above the average in mental ability but they are frequently not sociable and are single job performers. They tend to be introverts. Potential supervisors do not need as high a level of mental ability but they must be more sociable. They are frequently sportsmen, and may become joiners, club men and community leaders outside of their employment activities.

Technical Engineering Sales was stated to be an important and growing opportunity for those having an engineering training. Salesmen require strong personal qualities and a good service spirit with a keen interest in the customer's outlook and problems, which means in effect the objective outlook characteristic of extroverts. They also require a good technical training and habits of analytical thought and creative imagination characteristic of introverts. In addition direct knowledge of the manufacture and operation of their product lines is very important. This can only be obtained in its most useful form from direct operating experience.

Dr. Moore then discussed methods of classifying persons by their interests and aptitudes. Occupational growth involves a gradual selection of life interests and the exclusion of others. Occupational maturity is the condition where areas of interest are firmly established, and a reliable recommendation regarding occupational guidance can hardly be made before that condition is achieved. The level of aptitudes or abilities within the chosen area of interest is the second basis of classification. Personality traits are the third and least definite of the points of classification. This involves the type of personality whether objective or subjective, service spirit, loyalty, patience and emotional stability.

Dr. Moore said that he believed that about three to five per cent of the population should never be employed by any company.

The army type of leadership is not acceptable in industry, being developed for a peculiar set of conditions so that officers from the services do not necessarily fit well into supervisory positions in industry.

Industrial leadership requires, among other things, personal respect and room for individual initiative and judgment.

SAGUENAY BRANCH—JUNIOR SECTION

T. T. Anderson, jr.e.i.c. - *Secretary-Treasurer*

The fourth annual dinner meeting of the Saguenay Branch Junior Section was held in the banquet room of the Saguenay Inn on Wednesday evening, November 20th, 1946.

Present at the head table as guests of the Junior Section were Messrs. McNeely Dubose, P. H. Skelton and E. H. Eberts of the Aluminum Company of Canada Limited and F. T. Boutilier chairman of the Senior Section. Messrs. Dubose and Boutilier addressed the meeting on behalf of the Aluminum Company and of the Senior Branch, respectively.

The guest speaker was E. R. Complin of Canadian Industries Limited, who gave a most interesting and enjoyable talk. He was introduced by J. T. Madill, chairman of the Junior Section. Following his talk, Mr. Complin consented to answer questions and an interesting half-hour followed.

The speaker was thanked by H. A. Estabrook at the close of a most worthwhile evening.

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On Wednesday evening December 11th, at the Saguenay Inn, Mr. D. F. Nasmith of Aluminum Company of Canada, Ltd., addressed the Junior Section of the Sageunay Branch on the subject, **Some Applications of Statistical Technique in the Chemical Industry.** His address was illustrated by slides.

The history of statistical methods was briefly outlined by Mr. Nasmith. It was pointed out that the use of these methods in industry was very recent, dating only to about 1943.

Mr. Nasmith then described the background behind the construction of outline charts and showed a number of practical examples taken from chemical industry. Results of these applications were discussed. Correlation technique was next discussed and some examples given. It was emphasized that correlation calculations had proved quite valuable in analyzing data from plant operations where many complicated actions were often present. The use of various tests for significance was described and examples given. It was pointed out that a certain risk was always attached to any inference of significance. Brief references were made to the use of statistics in developing sampling methods and a wartime development, sequential sampling, was described.

In conclusion, the speaker pointed out that statistical techniques would not accomplish miracles but the evidence seemed to indicate that they had many applications in chemical industry, only a few of which have as yet been exploited.

The paper was very well received by the audience and an interesting question period followed.

The speaker was introduced by J. T. Madill and thanked by J. J. Miller. Refreshments were served after the meeting.

SAINT JOHN BRANCH

K. W. Salmon, jr.e.i.c. - *Secretary-Treasurer*
A. R. Bonnell, m.e.i.c. - *Branch News Editor*

The joint annual meeting of the Association of Professional Engineers of N.B. and the Saint John Branch of the Institute was held on January 23 in the Admiral Beatty Hotel, with L. O. Cass in the chair.

After refreshments and dinner a toast to the Association was proposed by L. S. Mundee and responded to by J. F. T. Morrison, newly elected president of the Association. A toast to the E.I.C. was proposed by Frank Vaughn and responded to by J. H. Scovil, president of the Engineering Society of the University of New Brunswick.

A paper was read by John N. Flood, one of the Canadian representatives to the International Labor Office Conference held recently in Brussels. Mr. Flood contrasted present living standards in London with those in Brussels, stressing the rigid rationing in Britain and the great spending and lack of rationing in Belgium. Mr. Flood also went into detail on the conference in Brussels, stressing the need for greater co-operation between employee and employer and noting the trend among the European delegates to the desire to eliminate private enterprise.

A vote of thanks to Mr. Flood was proposed by A. V. Tracy-Gould, and seconded by J. M. Lamb.

D. O. Turnbull read a paper on the construction of the new Atlantic Wholesalers warehouse. Mr. Turnbull went into detail on the economy of mechanical handling of goods in the new warehouse of one-storey construction, as compared to the older method of manual handling in the multiple-storied old warehouse.

R. E. Tweedale moved a vote of thanks to Mr. Turnbull, which was seconded by B. Hagerman.

Major H. J. C. MacLean then spoke briefly in the interest of the Reserve Force of the R.C.E.M.E.

The meeting was then adjourned.

SARNIA BRANCH

F. F. Walsh, m.e.i.c. - - - *Secretary-Treasurer*
S. V. Antenbring, jr.e.i.c. - *Branch News Editor*

The Sarnia Branch of the Institute held a dinner meeting at the Polymer Cafeteria on Friday evening, January 17th, 1947. The guest speaker was Dr. John J. Grebe, a director of the Dow physical research laboratory, Midland, Michigan.

Dr. Grebe spent a considerable time at the American atomic power experimental station at Oak Ridge and he was one of the scientific observers at the Bikini experiments. He displayed the official technicolor film released to the participating scientists by the United States Army and Navy, and also a series of slides of particular points in the Bikini experiments. Following the showing of the slides a question period ensued in which Dr. Grebe dealt effectively with many of the problems concerning atomic energy that are prominent in the public mind at the present time.

If used for the benefit of mankind, rather than as an instrument of war, nuclear energy, as a source of fuel, motive power, and other forms of energy, could make possible a world population of ten times the present figure which is limited to the facilities of the earth, Dr. Grebe reported. If used for the welfare of the people, nuclear energy would make it unnecessary for people to shift to crowded centres for specific raw materials, shipping facilities and fuel.

He pointed out that although the films showed the bomb as presenting a beautiful display, in reality it was terrible, ghastly and severe. The only hope of scientists is that good-will will prevail among nations and that the atom bomb will never again be used as a weapon of war. It is absolutely essential that nations realize the full potentialities for total destruction of this new instrument of warfare, Dr. Grebe emphasized. The American Association of Atomic Scientists are endeavouring to raise $1,000,000 to finance a campaign to bring this situation in its full gravity home to the average citizen. Further, he said that the realization of the seriousness of the situation on which we are poised is perhaps the only, and certainly the best guarantee of enduring peace.

Questioned as to the extent of Russian knowledge of atomic bombs, he declared that undoubtedly the Soviet scientists are at least as well advanced as were the Germans and they knew all that was necessary to utilize the effect of the atom. He credited the accuracy of British bombing for the failure of Germany to use the atom bomb before us.

Dr. Grebe praised the United States Army and Navy for their co-ordinated effort at Bikini. There were 42,000 men involved in the tests and of these only two men were killed. He pointed out that the experiments were a definite success and deplored the ill-considered criticism due possibly to the fact that the public were led to expect a great many things that did not happen, nor were they expected to happen by the authorities. It was not the aim of the experiment to prove the effectiveness of the bomb, but rather to ascertain its effect on implements of war, particularly naval vessels and personnel.

He revealed that the bomb weighed between 10 and 100 pounds, was about the size of an apple, and that one grain of matter would provide sufficient energy for such a bomb.

The effect of the radioactivity on personnel is to cause the marrow of the bones to become sterile thereby drying up the source of the red blood corpuscles.

Dr. Grebe deplored the lack of interest in the atom among the members of the engineering profession.

The speaker had been introduced by Dr. B. Hillary, and the vote of thanks, enthusiastically endorsed by the large audience present, was tendered by Frazer Davidson.

SASKATCHEWAN BRANCH

D. W. Houston, m.e.i.c. - - - *Secretary-Treasurer*
L. A. Dokken, m.e.i.c. - - - *Branch News Editor*

On Friday, January 17, 1947, our Saskatchewan Branch held its regular monthly meeting at the Kitchener Hotel in Regina. A general business meeting was held during which an amendment to the constitution of the Association of Professional Engineers was passed, enabling this group to handle the general increase of fees passed recently by the Institute members at large. A general news letter designed for circulation among Branch members, was then read by the branch news editor. This news letter service was approved in principle by the members who feel it is a worth while step towards a closer, more integrated group of engineers in Saskatchewan.

The group was then privileged to hear R. Peterson, head of the Soil Mechanics Branch of the P.F.R.A., give an illustrated talk on this very interesting and rather "new" field. After reviewing the history of this scientific phase of civil engineering, Mr. Peterson explained that the research on this subject is constantly altering our so-called established principles of soil as a bearing material. In this phase of this address, the fact was brought out that there is a wide variation between the geologist's definition of soil and that conception used by engineers in the soil mechanics field.

The speaker's introduction was followed by an explanation of practical soil mechanics and its relation to common misconceptions by engineers in practice. He also said a few words on the peculiarities of our Regina clay soils. Summing up, he stated that the changes in water content of soil had more to do with their behaviour under load than any other single factor. A very lively discussion took place following the address, which indicated the general interest in the subject.

R. Bing Wo thanked Mr. Peterson, and on a motion from the floor, Chairman F. E. Estlin declared the meeting adjourned.

TORONTO BRANCH

E. G. Tallman, m.e.i.c. - *Secretary-Treasurer*
E. R. Graydon, m.e.i.c. - *Branch News Editor*

The Annual Students' Night of the Toronto Branch was held on January 23rd in Hart House, at the University of Toronto. The meeting was jointly sponsored by the Senior and Junior Sections; and Ivan Widdifield, Junior Section chairman, presided. Great interest was shown by the students and preliminary contests were necessary to select six finalists from some thirty contestants.

About one hundred and seventy-five Branch members heard the six third and fourth year engineering students present their papers. First prize of fifty dollars, donated by the T Eaton Company, was awarded to W. M. Clarkson for his paper on **The Modern Low Head Propeller Turbine.** The remaining prizes presented by the Institute were as follows:

Second prize for thirty dollars to A. J. Prell for his paper, **Boiler Feed Water Conditioning;** third prize to H. Dederer, who spoke on **Mechanized Harvesting of Grain.** Consolation prizes of ten dollars each were awarded to the remaining three contestants: F. J. Humphrey, **Engineering Aspects of Aviation Medicine;** F. Weinberg, **The Photo Multiplier Tube;** and W. G. Ratz, **The Gas Turbine Locomotive.** In addition, all six contestants received Student membership in the Institute.

J. F. McLaren, Chairman of the Branch Committee on The Young Engineer, presented the prizes. He also presented the Institute's Student prize to Mr. Hendricks, a fourth year mechanical engineering student at the University of Toronto and one of the two Rhodes Scholars for this year.

Two films added to the enjoyment of the meeting. The first was "Arc Welded Structures" by Lincoln Electric, and the second "Preliminary Construction at Stewartsville" by the Hydro Electric Power Commission of Ontario. Refreshments served in the Great Hall brought a very successful meeting to a close.

VANCOUVER BRANCH

A. M. Eyre, s.e.i.c. - - - - *Secretary-Treasurer*
G. W. Allan, m.e.i.c. - - - *Branch News Editor*

The Vancouver Branch held its Annual Meeting on Saturday, November 22nd, at the University of British Columbia's Brock Memorial Hall.

After an enjoyable dinner, attended by eighty members, the business session was held.

Retiring chairman R. C. Pybus voiced his appreciation to the members of his executive for their assistance during his tenure of office and spoke of the growing opportunities for engineers in Vancouver and British Columbia, and also announced the award to Ben Quan, of the prize donated each year by W. N. Kelly to a university student for proficiency in shop practice.

The incoming chairman, J. P. Fraser, in taking office, expressed his appreciation to the members on his election as chairman of the Branch, and urged the amalgamation of the various engineering associations, of which there are several operating in Vancouver.

C. E. Webb reported on the present status of the Harry F. Bennett Educational Fund as far as the local Branch is concerned, and suggested that a subscription from any member who has not already subscribed to this deserving fund, would be appreciated.

The speaker of the evening, F. H. Soward, Professor and Director of International Studies at the University of British Columbia, was introduced by J. P. Fraser. Professor Soward chose as his subject **The Atomic Bomb and World Government.** He disclosed that atomic warheads now can be fitted to rocket bombs and warned that the only sure defence in the Atomic Age is complete international agreement. The atomic bomb has narrowed the spread between great and small nations, and he felt that there was every hope that nations can merge their sovereign ties, and that it rests with the citizens of each country to assure their governments they are willing to join such world organizations. Because of the cheapness of manufacture and the terrible efficiency of the bomb, we may see some remarkable changes in small countries that are now lacking in raw materials. Professor Soward suggested that in from three to ten years, every small nation should be able to manufacture atomic bombs. The size of mines and plants necessary to develop atom bombs, and the fact that any country would have to test bombs before using them, made international control possible.

At the conclusion of the address J. P. Fraser thanked the speaker for his interesting talk.

Library Notes

Book notes, Additions to the Library of The Engineering Institute, Reviews of New Books and Publications

BOOK REVIEW

EVALUATION OF EFFECTS OF TORSIONAL VIBRATION

S.A.E. War Engineering Board, New York Society of Automotive Engineers, 1946, 578 pp., illus., cloth, $10.00

Reviewed by J. P. Uffen*

Development of Improved Means for Evaluating Effects of Torsional Vibration on Internal Combustion Engine Installations is the result of the response of the S.A.E. War Emergency Board to an appeal by the U.S. Navy for the development of improved means for evaluating the effects of torsional vibrations in Diesel and other reciprocating engines. The board considered it necessary first to establish an understanding of the pertinent details involved in present-day practices, and the book consists of accounts of those of four engine manufacturers.

An outline of the general subject is given and a review of the written discussions. Conclusions and recommendations to the Navy are made. The remainder of the work consists of a report by each of the firms included, each report being divided into four phases. They are reviewed collectively, by phase, below.

Phase one deals with the measurement of torsional vibration. Optical, mechanical, electrical phase shift, and seismic torsiographs are explained in detail. The description of the seismic type contains an excellent account of the associated amplifiers. The calibration of these instruments is stressed. Hooke's joint, oscillating beam, and walking beam calibrators are presented critically and the limitations of each discussed.

The second phase deals with the estimation of stress. The distributed-mass method of calculation is given with graphs and tables to expedite the work. An example is worked in detail and compared with the Holzer procedure. Mathematical short-cuts for the Holzer method are given and their accuracy discussed. Simplified methods of obtaining natural frequencies are given, and reference is made to electrical analogies but not enlarged upon adequately. Detailed analyses of dampers are presented with reference to large angles of swing and include numerous graphs and charts to assist in arriving at a workable design.

The significance of estimated stresses as derived from calculation or torsiograph measurement is discussed in phase three, with reference to the effect of fillets, oil holes, the endurance limit of the material, residual stress, and surface treatment. Brittle lacquer methods and strain gauge techniques are discussed in detail.

Phase four suggests that, at present, the mechanical torsiograph is the simplest and most reliable to enable unspecialized personnel to determine dangerous degrees of vibration.

The format of the book with its topical repetition from each firm detracts much from its usefulness as a text: the continuity of the discussion of each phase is lost. However, valuable data is given competently in detail and comprehensive bibliographies are included, making it an excellent reference work for Technologists and Engineers concerned with vibration work.

Junior research engineer, Structures Laboratory, Division of Mechanical Engineering, National Research Council, Ottawa, Ont.

ADDITIONS TO THE LIBRARY

TECHNICAL BOOKS, ETC.

Advanced Mathematics for Engineers; 2 ed.:
H. W. Reddick and F. H. Miller. N.Y., Wiley, c1947. 508 p., illus., cloth.

Automotive Mechanics:
William H. Crouse. N.Y., McGraw-Hill; Toronto, Embassy, c 1946. 473 p., illus., cloth.

Engineering Designs for Re-Planning:
Edited by J. B. Pinkerton. London, Princes Press, 1946. 97 p., illus., paper. (Reprinted from Air-Treatment Engineer).

Geology for Engineers; 2 ed.:
F. G. H. Blyth. London, Edward Arnold; Toronto, Longmans, Green, 1945. 329 p., illus., cloth.

Industrial Electric Heating and Electrical Furnaces:
E. S. Lincoln. N.Y., Essential Books; Toronto, Collins, c1945. 192 p., illus., cloth.

Literature Search on the Preservation of Food by Freezing:
B. H. Weil and Frances Sterne. Atlanta, Georgia School of Technology, 1946. 409 p., paper. (Special Report No. 23).

National Fire Codes, Vol. 5, National Electrical Code, 1947:
National Fire Protection Association, Boston, c1946. 376 p., cloth. (ASA C1-1946).

Organization of Official Traffic Agencies in Cities and States:

Wilbur S. Smith. Saugatuck, Conn., Eno Foundation for Highway Traffic Control, 1946. 100 p., illus., paper.

Organized Labor and Production; Next Steps in Industrial Democracy; rev. ed.:
Morris Llewellyn Cooke and Philip Murray. N.Y., Harper, c1946. 277 p., cloth.

Radiant Heating:
T. Napier Adlam. N.Y., Industrial Press., c1947. 472 p., illus., fabrikoid.

Rock Tunneling with Steel Supports:
R. V. Proctor and T. L. White, with an Introduction to Tunnel Geology by Karl Terzaghi. Youngstown, Ohio, Commercial Shearing & Stamping Co., c1946. 271 p., illus., fabrikoid.

Terminal Airport Financing and Management:
Lynn L. Bollinger, Alan Passen and Robert E. McElfresh. Boston, Graduate School of Business Administration, Harvard University, 1946. 385 p., cloth.

These were the Nerves: the Story of the Electric Cable and Wire Industry of Great Britain during the years of war:
Douglas Reekie. London, Insulated Conductors Export Group, (1946). 128 p., illus., cloth.

Women Can Be Engineers:
Alice C. Goff. Youngstown, Ohio, A.C. Goff; Ann Arbor, Mich., Edward Bros., 1946. 227 p., cloth.

PROCEEDINGS, TRANSACTIONS, ETC.

American Public Works Association:
Public Works Congress Reports, 59th Annual Meeting, 1946.

Engineering College Research Association:
Proceedings of the Annual Meeting, 1946.

Institution of Electrical Engineers:
Proceedings of the Radiolocation Convention, 1946. (Vol. 93, Part 111A, No. 3).

New Zealand Institution of Engineers:
Proceedings, Vol. 32, 1946.

ANNUAL REPORTS, ETC.

British Engineers' Association:
Classified Handbook of Members and their Manufactures, 1946.

Canada. Dominion Bureau of Statistics.
Report on the Construction Industry in Canada, 1945.

Manitoba. Dept of Mines and Natural Resources:
Seventeenth Annual Report on Mines and Minerals, 1944-45.

Quebec (Prov.) Dept. of Trade and Commerce:
Statistical Year Book, 1945-46.

TECHNICAL BULLETINS, ETC.

American Society of Mechanical Engineers:
Notes of Submarine Design, A. I. McKee. (Paper No. 46-A-61).

Canada. Dept. of Reconstruction and Supply. Economic Research Branch:
Chart Book of Employment and Payrolls in Canadian Industries —Employment 1939-1946; Payrolls 1941-1946.

Comite International de L'Organisation Scientifique (CIOS):
Eight International Management Congress, Stockholm, 1947, Bulletin No. 1, November, 1946.

Electrochemical Society. Preprints:
90-33—Characteristics of the Silver Chloride-Magnesium Water Activated Battery, J. B. Mullen and P. L. Howard.-09-34—Control of pH in Nickel Plating Solutions, H. Bandes.- 90-35—Effect of Cell Variables on the Electrowinning of Manganese, J. H. Jacobs.--90-36—Polyethylenes, A. E. Maibauer and C. S. Myers.- 90-37—Electrographic Methods of Analysis, Eric A. Arnold—90-38—Dry Cell Dynamics: The Bobbin, J. J. Coleman.

Institution of Mechanical Engineers. Advance Papers:
Mechanical Engineering and Agriculture, S. J. Wright. (First Agriculture Lecture).
. . . Progress in Turbine Gear Manufacture in Recent Years, A. Sykes.
. . . Measurement of Errors in Gears for Turbine Reduction Drives, C. Timms. (Bound with A. Sykes' Paper).

Institution of Structural Engineers:
Regulations Governing Admission to Membership; Examination Syllabuses, 1946.
. . . Scale of Charges for Consulting Structural Engineers, 1946.

North-East Coast Institution of Engineers and Shipbuilders:
Combustion of Fuels, Alfred C. Egerton. (Fifteenth Andrew Laing Lecture, 1946).

Princeton University. Industrial Relations Section:
State Legislation for Cash Sickness Benefits. (Selected References, No. 13, 1947).

Purdue University. Engineering Extension Dept.:
Proceedings of the Second Industrial Waste Conference, 1946. (Extension Series No. 60).

U.S. Bureau of Mines. Technical Papers:
No. 694—Prospecting for Mineralization in Steeply Dippling Beds covered by Glacial Till, Talus, and Weathered Zones, F. W. Lee, H. L. Scharon and C. H. Sandberg.

U.S. Geological Survey Professional Papers:
205-D—Late Mesozoic and Early Cenozoic History of Central Urah.--206—Upper Cretaceous Foraminigera of the Gulf Coastal Region of the United States and Adjacent Areas.—207—Geology and Paleontology of Palos Verdes Hills California.—210-A—Tertiary Foraminifera from St. Croix, Virgin Islands.

U.S. Geological Survey Water-Supply Papers:
986—Water Levels and Artesian Pressure in Observation Wells in the United States in 1943—Part 1—Northwestern States.-1001—Surface Water Supply of the United States, 1944-Part 1 —North Atlantic Slope Basins.-1002—op. cit.—Part 2-South Atlantic Slope and Eastern Gulf of Mexico Basins.-1005—op. cit.—Part 5—Hudson Bay and Upper Mississippi River Basins.-1006—op. cit.—Part 6—Missouri River Basin.-1008—op. cit.-Part 8—Western Gulf of Mexico Basins.-1012—op. cit.—Part 12 —Pacific Slope Basins in Washington and Upper Columbia River Basins.

STANDARDS, SPECIFICATIONS, ETC.

Edison Electric Institute:
TD-12, 1946—Specifications for Pole Guards. TD-15, 1946—Specifications for Pole and Tower Steps.

Codes of Practice Committee:
CP(B) 624—Masonry Walls with Natural and Cast Stone Ashlar Facing.

PAMPHLETS, ETC.

Accredited Undergraduate Engineering Curricula:
Engineer Council for Professional Development. (Preprinted from Fourteenth Annual Report, 1946).

Conservation of Soil:
Royal Bank of Canada. August 1946.

Pipe Coils; including Comprehensive Listing of Types of Pipe Coils, Materials, Pipe Data, Engineering Data, Accessories:
Crane Limited, Montreal, 1946. (Circular No. M-318).

BOOK NOTES

The Institute does not assume responsibility for any statements made; these are taken from the preface or the text of the book.

The following notes on new books appear here through the courtesy of the Engineering Societies Library of New York, and may be consulted at the Institute Library.

A.S.T.M. STANDARDS on GLASS and GLASS PRODUCTS

Prepared by A.S.T.M. Committee C-14 on Glass and Glass Products. Methods of Testing; Specifications. Nov. 1946. American Society for Testing Materials, Philadelphia, Pa. 86 pp., illus., diagrs., charts, tables 9 x 6 in., paper, $1.25 (A.S.T.M. members, $.95).

Definitions, specifications, and methods of testing of glass, glass containers, glass insulators, and glass textiles are presented. The twenty-six items cover both accepted and tentative standards, and include a few selected ones prepared by other committees which are applicable in the glass industry.

ELECTRICAL ENGINEERING

E. E. Kimberly. 2 ed. International Textbook Co., Scranton, Pa., International Correspondence Schools Canadian Ltd., Montreal, 1946. 407 pp., illus., diagrs., charts, tables, 9¼ x 6 in., cloth, $3.50.

Written specifically for the engineering students not majoring in electrical engineering, this text is designed to enable them to deal understandingly with electrical problems and electrical engineers, and to select electric power equipment intelligently. It covers, in a functional manner, electric and magnetic theory, electric circuits and machinery, both S.C. and D.C., batteries, transformers, illumination, electric heating, and electronic devices. Consideration is also given to the economics of the use of electrical apparatus.

ENGINEER AT LAW:

C. B. McCullough and J. R. McCullough, with forewords by J. T. Brand and J. M. Devers. Iowa State College Press, issued in 1946 by The Collegiate Press, Ames, Iowa, under cooperative agreement with the Oregon State Highway Department. 9¼ x 6 in., cloth, Vol. 1, 447 pp.; Vol. 2, 442 pp.; $3 each Vol., $6 both vols.

The object of this work is to provide the engineer with a source of information which will help him to avoid legal pitfalls and to deal more efficiently with problems which arise if legal difficulties do occur. Volume I covers court procedures, systems of jurisprudence, and equity considerations. It discusses the important topics of contracts and contractual relationships, engineering specifications, real property laws, and torts incident to engineering operations. Volume II considers the engineer in trial work as technical witness or consultant, and deals with employment relations, patents, negotiable instruments, and numerous special laws of interest to the engineer.

ENGINEERING DESIGNS FOR RE-PLANNING:

Edited by J. B. Pinkerton. Princes Press, Westminster, London, S.W.1, 1946. 97 pp., illus., diagrs., maps, tables, 12 x 9½ in., paper, 5s.

Selected from the magazine, "Air Treatment Engineer", the articles reprinted here demonstrate various methods used by engineers in reconstruction work on the mechanical equipment of various types of buildings: libraries, hospitals, residences, etc. There is an index showing on which pages certain boilers, pumps, etc., are described.

HEAT TREATMENT OF CARBON STEELS:

F. Johnson. Chemical Publishing Co., Brooklyn, N.Y.; General Publishing, Toronto, 1946. 204 pp., illus., diagrs., charts, tables 8¾ x 5½ in., cloth, $5.60 (in Canada).

This volume is the first of a series of four intended to provide a source of information on the treatment which metals and alloys receive before being delivered to the engineer for his use. The present volume covers the influence of composition and treatment on the structure and properties of carbon steel, the various practical heat-treating operations, the important topic of hardenability, and the description and testing of mechanical properties. Succeeding volumes will deal with alloy steels, cast iron, and non-ferrous alloys; surface-hardening processes; furnaces and pyrometry.

INDUSTRIAL ELECTRIC HEATING and ELECTRICAL FURNACES:

E. S. Lincoln. Essential Books, Duell, Sloan and Pearce, New York; Collins, Toronto, 1945. 192 pp., illus., diagrs., charts, tables, 8¼ x 5¼ in., cloth, $3.50 (Can.).

The three principles of electric heating—resistance, infra-red and induction—are discussed, with detailed descriptions of the equipment by which they are put to practical use. Electric steam boilers, electric ovens and dryers, and electric furnaces are dealt with particularly, including discussion of efficiencies and the calculation of heating requirements. Space is devoted to the selection and installation of heating units.

Literature Search on the PRESERVATION OF FOODS BY FREEZING:

B. H. Weil and F. Sterns. Georgia School of Technology, State Engineering Experiment Station, Atlanta, Ga., June, 1946. 409 pp., 8½ x 5½ in., paper, $4.00. (Special Report No. 23.)

Over 2,000 abstracts of articles and digests of patents are contained in this bibliography, arranged alphabetically by author. While not exhaustive, the object has been to include all important items dealing directly with food freezing and certain other references which contribute engineering or other information of value on the general subject. A 60-page alphabetical subject index provides detailed access to the material covered.

MEXICAN-AMERICAN CONFERENCE on INDUSTRIAL RESEARCH, September 30—October 6, 1945:

Apply to S. C. Pappageorge, Armour Research Foundation of Illinois Institute of Technology, 35 West 33rd St., Chicago 16, Ill. 176 pp., diagrs., charts, maps, 9 x 6 in., paper, $2.50.

The twenty-two papers presented at the Conference are printed here in full, describing representative types of university research, foundation research, Government research, and research in private industry in a wide variety of fields. General patterns of research, both in national and international, are discussed, and the value of standards to American industry is briefly considered together with some descriptions of the work of two large standardizing bodies, the American Standards Association and the National Bureau of Standards.

MODERN ORGANIC FINISHES, their Application to Industrial Products:

R. H. Wampler. Chemical Publishing Co., Brooklyn, N.Y.; General Publishing Co., Toronto, 1946. 452 pp., illus., diagrs., 8½ x 5½ in., cloth, $11.90 (in Canada).

This book is primarily a book of methods. Descriptions of modern finishing materials and equipment for their application, drying and conveying are presented, with emphasis on the proper selection and proper use of materials and equipment to get the best possible finish at minimum cost. Enamels, lacquers, varnishes, stains and "synthetics" are mainly considered, with little consideration given to oil-base paints.

ORGANIZED LABOR AND PRODUCTION, Next Steps in Industrial Democracy:

M. L. Cooke and P. Murray. Rev. ed. Harper & Brothers, New York and London, 1946. 277 pp., diagrs., charts, 8¾ x 6 in., cloth, $2.50.

A prominent expert in scientific management and the head of a leading union join in setting forth what they both believe is the basis for greater collaboration among employers and organized workers to assure greater production under fair terms of employment. The book covers the responsibilities and activities of both labor and management and discusses some of the questionable practices of both.

PRINCIPLES of RADAR:

By members of the staff of the Radar School, Massachusetts Institute of Technology. 2 ed. McGraw-Hill Book Co., New York and London, Embassy Bk Co., Toronto, 1946. paged in sections, diagrs., charts, tables, 9 x 6 in., cloth, $5.00.

Originally prepared for use in war training courses, this comprehensive work has been revised to bring the subject matter up to date. It begins with a brief description of the components and functions of radar systems and continues with detailed discussion of typical system components. The intent has been to give a technically thorough and accurate treatment with minimum dependence upon mathematics. Emphasis in the treatment of circuits is upon quantitative analysis directly from tube characteristics and physical principles.

RADIO TUBE VADE-MECUM, 6th ed. 1946:

P. H. Brans. Editions Techniques P. H. Brans, 28 rue du Prince Léopold, Antwerp (Borgerhout) Belgium. 232 pp., diagrs., tables, 10½ x 7¼ in., paper, 105 Belgian francs.

The first seven tables of this manual are the same as in previous editions and are as follows: characteristics of the most widely used tubes, including static characteristics and working data; characteristics of tubes less used on the Continent, chiefly British; listing of tubes having same electrical characteristics as certain ones in table I; tubes with approximately similar characteristics for use as replacements; diagrams of tube sockets; characteristics of Russian tubes; Allied Army tubes corresponding to commercial tubes. This 1946 edition also includes the characteristics of German and Italian army tubes. All headings are given in Dutch, French, English and German. The directions for use in the 1946 edition are in English only.

REFERENCE DATA for RADIO ENGINEERS, 2 ed.:

Published by Federal Telephone and Radio Corporation, an associate of International Telephone and Telegraph Corporation, 67 Broad St., New York, Federal Electric Manufacturing Co. Ltd., Montreal, 1946. 322 pp., diagrs., charts, tables. 8½ x 5½ in., fabrikoid, $2.00.

This useful compilation of reference data has been considerably revised and enlarged in order to keep up with the rapid advances in the art. It covers audio and radio design, vacuum tubes and other equipment, acoustics, wire transmission, wave guides and resonators, as well as general engineering and material data and mathematical formulas and tables. The chapters on transformers and room acoustics are new, and noteworthy additions have been made to the material on cathode-ray tubes, electrical circuit formulas, and wave guides. A detailed subject index has been included in this new edition.

SCIENCE: Its Effect on Industry, Politics, War Education, Religion and Leadership:

D. W. Hill. Chemical Publishing Co., Brooklyn, N.Y., General Publishing Co., Toronto, 1946. 114 pp., 8¾ x 5½ in., cloth, $2.75.

In a series of seven essays the author briefly discusses the scientific outlook and the effect of science on industry, politics, war, education, religion and leadership. The object of the whole is to demonstrate that the application of the scientific method, or way of thinking, to these diverse fields can lead to social and economic, as well as technical, progress, despite the inherent weaknesses and difficulties which exist.

(Continued on page 96)

PRELIMINARY NOTICE

of Applications for Admission and for Transfer

February 10th, 1947

The By-laws provide that the Council of the Institute shall approve, classify and elect candidates to membership and transfer from one grade of membership to a higher.

It is also provided that there shall be issued to all corporate members a list of the new applicants for admission and for transfer, containing a concise statement of the record of each applicant and the names of his references.

In order that the Council may determine justly the eligibility of each candidate, every member is asked to read carefully the list submitted herewith and to report promptly to the Secretary any facts which may affect the classification and selection of any of the candidates. In cases where the professional career of an applicant is known to any member, such member is specially invited to make a definite recommendation as to the proper classification of the candidate.*

If to your knowledge facts exist which are derogatory to the personal reputation of any applicant, they should be promptly communicated.

Communications relating to applicants are considered by the Council as strictly confidential.

The Council will consider the applications herein described at the March meeting.

L. Austin Wright, General Secretary

*The professional requirements are as follows:—

A **Member** shall have been engaged in some branch of engineering for at least six years, which period may include apprenticeship or pupilage in a qualified engineer's office or a term of instruction in a school of engineering recognized by the council. In every case a candidate for election shall have held a position of professionl responsibility for at least two years. The occupancy of a chair as professor, assistant professor, associate professor or lecturer in a faculty of applied science or engineering, shall be considered as professional responsibility.

Every candidate who has not graduated from a school of engineering recognized by the council shall be required to pass an examination as prescribed by council, on the theory and practice of engineering, with special reference to the branch of engineering in which he has been engaged.

A **Junior** shall have been engaged in some branch of engineering for at least four years. This period may be reduced to one year, if the candidate for election has graduated from a school of engineering recognized by the council, in which case he shall not remain in the class of Junior beyond the end of the eighth year after graduation.

Every candidate who has not passed the examinations of the third year in a school of engineering recognized by council shall be required to pass an examination in engineering science as prescribed by council. He shall not remain in the class of Junior beyond age thirty.

A Junior may be transferred to Member without payment of transfer fee providing he makes application before the end of the seventh year after graduation or, if a non-graduate, before attaining age twenty-nine, and his application is approved by council.

Council may extend the above limits if in its opinion special circumstances warrant such extension.

A **Student** shall be at least seventeen years of age, and shall present a certificate of having passed an examination equivalent to the final examination of a high school, or the matriculation of an arts or science course in a school of engineering recognized by the council or shall be required to write examinations as prescribed by the council.

He shall be:

a. pursuing a course of instruction in a school of engineering recognized by the council, in which case he shall be transferred to Junior automatically without payment of transfer fee in the second January after graduation, or

b. receiving a practical training in the profession in which case he shall be transferred to Junior without payment of transfer fee providing he makes application before attaining age twenty-five and his application is approved by council.

He shall not remain in the class of Student after he has attained the age of twenty-five, unless in the opinion of council special circumstances warrant the extension of this age limit.

An **Affiliate** shall be one who is not an engineer by profession but whose pursuits, scientific attainments or practial experience qualify him to co-operate with engineers in the advancement of professional knowledge.

The fact that candidates give the names of certain members as reference does not necessarily mean that their applications are endorsed by such members.

FOR ADMISSION

BALL—ROBERT SPENCER, of 908 Roberts St., Niagara Falls, Ont. Born at Yorkshire, Eng., Dec. 10, 1922. Educ.: B.A.Sc., (Mech.), Toronto, 1946; May 1946-Feb. 1947, jr. engr., H. G. Acres & Co., Niagara Falls; at present, assignment engr., Canadian Cellucotton Products Co., Ltd., Niagara Falls, Ont.

References: E. A. Allcut, S. W. Andrews, W. P. London, G. R. Lord.

BARR—FRANCIS ELMO, Capt. R.C E., of Saint John, N.B. Born at Weymouth, N.S., Feb. 20, 1919. Educ.: B.Sc., (with Engrg.), Acadia, 1940; with Govt. mining-geo. survey party, 1938, (4 mos.), as geologist and dftsman., 1939, (5 mos.), chief of party; 1940-41, asst. engr., (constrn. Pennfield Airport, N.B.), Dept. National Defence; with R.C.E., as follows: 1941-46, 2/Lt., overseas, various positions of command, military engrg., 1946, (7 mos.), seconded to War Assets Corp., U.K. repr. sale of surplus military engrg. equipt. to foreign countries; 1946 to date, enlistment in post war army as Capt., R.C.E., A & T Staff Officer, 1st Field Coy., Saint John, N.B.

References: T. H. Dickson, A. A. Turnbull, D. R. Webb, H. P. Lingley, L. G. C. Lilley.

BRICOUT—PIERRE, of Quebec City. Born at Cambrai, France, Feb. 4, 1898. Educ.: Licenciz ès Sciences maths., 1924; Docteur ès Sciences physiques, 1927, Ecole Poly., Paris; Ing. élect., Ecole Supérieure d'Electricité, Paris, 1922 (accredited); Life Member: Société française de Physique, Socizt7 française des Electriciens, Sociztz française des Radioélectriciens; Assoc. Member, Inst. Electrical Engineers, London; Fellow, Physical Society, London; 1928-42, teaching physics, Ecole Poly., Paris; during period, consultg. engr. up to 1946 for the following: Energie électrique du Littoral Méditerranéen, Electricité et Gaz de Nice, Comptoir des Textiles Artificiels; 1932-34, placed i/c research by Ministry of Air, France; 1938-40, tech. dir., Revue Générale d'Electricité, Paris; also the author of "Ondes et Electrons," "La Resonance Atomique," etc., etc.; at present, professor of Elect. Engrg., Laval University, Quebec, Que.

References: C. Boisvert, R. Desjardins, E. D. Gray-Donald, G. E. Sarault, R. Dupuis, E. A. Bouchard.

CARRUTHERS—WILLIAM KENT, of Calgary, Alta. Born at Banff, Alta., Jan. 3, 1910. Educ.: B.Sc., (Elect. Engrg.), Alberta, 1933; R.P.E., Alberta; 1928-32, app. machinist, C.P.R. Shops, Lethbridge, Alta.; 1933-35, machinist, fireman, steel erection and elect. mtce., Dept. Public Works, Ponoka, Alta.; with Calgary Power Co., Ltd., as follows: 1935-40, grad. engrs. course, hydro plant foreman, line mtce., meter repairs, asst. engr. in engrg. dept., 1938-40, asst. plant supt., mtce. and repair of hydraulic prime movers, generators, switchgear and genl. plant operations, etc.; 1940-45, R.C.C.S., overseas; 1945-46, designing engr., prod. dept., Calgary Power Co., Ltd., Calgary; 1946 to date, field and office engr. on erection, plant, design and plant operation, Montreal Engineering Co., Ltd., Montreal, Que.

References: H. R. Randle, H. B. LeBourveau, T. D. Stanley, J. McMillan, H. B. Sherman, G. H. Thompson.

DIES—G. DONALD, of 447 Glengarry Ave., Toronto, Ont. Born at Shannonville, Apr. 15, 1920. Educ.: B.Sc., (Metall. Engrg.), Queen's, 1943; R.P.E., Ontario; 1940-42, (summers), asst. chemist, responsible for analyses of cement, gypsum, etc.; 1 mo. during period, constrn. imspctr., responsible for concrete control, reinforcing and genl. supvn. Canada Cement Co., Toronto; 1943-46, Elect. Mech. Engr. Officer, E.M.E., R.C.E.M.E.; 1946 to date, asst. constrn. engr., Canada Cement Co., Toronto, Ont.

References: J. B. Hanly, V. C. Hamilton, H. B. Howe, J. Narsted.

KEOUGH—JOHN EDGAR, of Sarnia, Ont. Born at Norwich, Ont., June 13, 1924 Educ.: B.Sc., (Mech.), Queen's, 1946; utility engr. in steam and power plant, Polymer Corporation Limited, Sarnia, Ont.

References: E. W. Dill, F. F. Walsh, L. A. Petrie, C. S. Phelps, J. W. Graeb.

LAIDLAW—CLINTON T., of Sarnia, Ont. Born at Aylmer, Ont., May 9, 1891. Educ.: B.Sc., (Civil), Queen's 1913; R.P.E., Ontario; 1911-13, (summer), instru'man., Quebec Bridge; 1913-14, asst., engrg. staff, City of Edmonton; 1914-16, private engrg. and surveying, Detroit, Mich.; 1916-19, engrg. staff, Ford Motor Co., Detroit, Mich.; 1919-30, private engrg. and constrn., Windsor, Ont.; 1931-38, Dept. Highways, Ontario, 1938-40, private constrn., Kitchener, Ont.; 1940 to date, city engr., City of Sarnia, Ont.

References: F. F. Dyer, G. L. Macpherson, J. C. Keith, G. R. Henderson C. F. Davison.

OSTERLAND—CLIFFORD DONALD, of Winnipeg, Man. Born at Melby, Minn., Aug. 28, 1900. Educ.: B.Sc., (Elect. Engrg.), Alberta, 1926; with Canadian General Electric, as follows: 1926-27, test course; 1927-28, student engrg.; 1928-29, sales engr.; 1930-35, switchgear engrg.; 1935-47, sales engr., and at present mgr. apparatus dept., Winnipeg district.

References: E. V. Caton, H. L. Briggs, H. R. Sills, T. E. Storey, L. M. Hough, C. P. Haltalin.

POWELL—THOMAS CLIFFORD, of Kingston, Ont. Born at Toronto, Ont., Aug. 11, 1915. Educ.: B.A.Sc., Toronto, 1938; 1935-38, (summers), geological field, exploration work and mining, with various mining companies; 1938-39, (6 mos.), res. geologist and engr., Powell-Rouyn Gold Mines Ltd.; 1939, (7 mos.), asst. mining engr., Millcarrow Mining Syndicate; 1939-40, materials inspctr., Noranda Mines Ltd.; 1940-42, British Air Commission; 1942, (5 mos.), asst. engr., John Inglis Co., Ltd.; 1942-43, (7 mos.), project engr., Sutton-Horsley Co., Ltd.; 1943 to date, prod. sr. foreman, Canadian Industries Ltd., Nylon divn., Kingston, Ont.

References: G. T. L. Andrews, R. D. Bennett, J. D. Lee, J. E. Thom, J. R. Carter.

SCHUTTE—OTTO WALTER, of Montreal, Que. Born at Holzminden, Germany, Dec. 26, 1902, (naturalized Canadian). Educ.: Civil Engr., Tech. High School, Hannover, Germany, 1923; 1926-30, structl. design and supvr., res. engr., grain elevator constrn., C. D. Howe Co., Ltd.; 1930-32, convalescing; 1932-34, res. engr., highway constrn., Ontario Dept. Northern Development; transit, topo. survey, Manitoba Dept. Mines and Natural Resources; 1934-41, engaged in other than engrg.; with Fraser-Brace Engrg. Co., Ltd., Montreal, as follows: 1941-43, material control, placing of job contracts, 1943-44, convalescing, 1944-46, estimating, scheduling, cost analysis, 1946 to date, plant layout, specifications, genl. engrg.

References: G. R. Stephen, A. T. E. Smith, F. S. Small, G. R. McLennan J. M. Fleming, H.Os.

SOBOLEWSKI—JERZY JOZEF, of Montreal, Que. Born at Tarnopol, Poland, July 4, 1914. Educ.: Mech. Engr., Politechnika Lwowska, 1939; Ingenieur-Electricien, Institut Polytechnique, Grenoble, France, 1942; R.P.E., Quebec (licensed); 1937-39, mach. lab. asst. at Institute of Technology, Poland, research in field of internal comb. engines; 1939, asst. to chief engr., engine testing dept. National Aircraft Works, Warszawa-Rzeszow, Poland; 1943-45, group leader in engrg. dept. (design office), Canadian Car & Foundry Co., Ltd., aircraft divn., Montreal; at present, design engr. in power plant section, Canadair Limited, Montreal, Que.

References: D. Goldwag, E. A. Harvey, D. C. MacCallam, J. Pawlikowski S. Rodwin.

TAKAHASHI—WILLIAM YOSKITO, of Montreal, Que. Born at Vancouver, B.C., Dec. 1, 1921. Educ.: B.Sc., (Elect.), Manitoba, 1943; B.Sc., (Mech.), Saskatchewan, 1946; 1946 to date, jr. engr., Dominion Bridge Co., Ltd., Montreal, Que.

References: E. P. Fetherstonhaugh, R. A. Spencer, I. M. Fraser, N. M. Hall, J. Smith.

FOR TRANSFER FROM THE CLASS OF JUNIOR

BOYLE—THOMAS JAMES, of Montreal, Que. Born at Crystal Springs, Sask., April 27, 1916. Educ.: B.Sc. (Civil), Sask. 1937; 1938 (4 mos.), inspector, Building Construction Dept.; 1939-40, intru'man i/c of party, Fed. Dep't. of Agriculture; 1940 (5 mos.), instru'man, Dept. of Civil Aviation, Calgary, Alta; with Hamilton Bridge Co. as follows: 1940-43, draftsman, structural steel detailing; 1943-46, asst. designing engr; 1946 to date, asst. engr., Canadian Pacific Railway, Montreal, Que. (Jr. 1939).

References: E. K. Phillips, R. A. Spencer, C. C. Parker, W. S. Macnamara, A. Love, G. E. Shaw, C. Neufeld.

BRADSHAW—THOMAS EARL, of Winnipeg, Man. Born at Winnipeg, Man. March 14, 1920. Educ.: B.Sc. (Elect.), Manitoba, 1942; 1942-46, Canadian Army, E.M.E., responsible for repair and mtce. of all army equipment on charge to units serviced by detachment; 1946 (11 mos.), equipt. engr., Northern Electric Co.; at present, asst. sales and service mgr. Bedard-Girard Ltd., Montreal, Que. (St. 1941. Jr. 1946).

References: E. P. Fetherstonhaugh, N. M. Hall, L. A. Galler, E. Grant, R. Wilson.

CRAIG—CLARENCE EDWARD, of Kingston, Ont. Born at Cobalt, Ont. June 28, 1914; Educ.: B.Sc. (Mech.), Queen's ,1938; 1938-43, layout and design engr., Horton Steel Works Ltd., Fort Erie, Ont.; with Aluminum Co. of Canada Ltd. as follows: 1943-45, forge div., production development department; 1945 (6 mos.), i/c of estimating, methods department; (4 mos.), asst. supt., tubing and extrusion dept., Kingston, Ont. (St. 1938. Jr. 1944).

References: W. R. Manock, C. S. Boyd, A. Jackson, D. S. Ellis, M. G. Saunders, L. F. Grant.

CUMMINGS—GEORGE WILLIAM, of St. John's, Nfld. Born at St. John's, Nfld., Jan. 13, 1917. Educ.: B. Eng. (Civil), Nova Scotia Tech., 1944; R.P.E., of Ontario; 1941-42 (9 mos.), chainman, instru'man, note-keeper and part time party chief, United States Engrs. Fort Pepperrell, Nfld.; (4 mos.) foreman on concrete switching station, Nfld. Light & Power Co.; summer 1944, designed and built as engineer i/c masonry gravity dam for private enterprise; 1945 (5 mos.), Jr. engr. drafting and designing, J. W. Beretta Engrs. Inc., Texas; 1946 (9 mos.), asst. estimator, Russell Construction Co., Toronto; Now intends to start consulting engrg. practice in structl. engrg., St. John's Nfld. (St. 1944. Jr. 1946).

References: S. Ball, J. W. March, J. O. Roddick, C. J. Townsend, R. V. Moores.

GORDON—JOHN EDWARD, of Galt, Ont. Born at Dundas, Ont. Sept. 1, 1909. Educ. B.Sc. (Mech.), Queen's 1936; with Whitehall Machine & Tools Ltd., as follows: 1938-39, assembly foreman; 1939-40 inspector first class D.N.D.; 1940-45, technical advisor, Gauges, I.B.U.K. & Canada; 1945-46 chief engr. and asst. mgr., Galt, Ontario. (St. 1935. Jr. 1946).

References: H. G. Bertram, R. L. Franklin, D. MacMillan, B. O. Heron, J. I. Carmichael, R. K. Thoman, W. M. Warnick.

LEACH—T. A. J., of Regina, Sask. Born at Kamsack, Sask. Nov. 11, 1915. Educ.: B.Sc. (Civil) Sask.; 1938; 1938 (5 mos.), St. asst. placing ground control for air survey in N.W.T.; 1938-40, instru'man, water rights branch P.F.R.A. i/c party on survey of irrigation and stockwatering, dams, construction, submitting estimates of work done; 1940-42, Jr. engr. Dept. of Transport (civil aviation Div.) i/c of survey for airport runways, layouts and constrn.; 1942-45, Lieut. R.C.E., working on survey control through Europe, locating radar stations, airport constrn. and air photo interpretation; 1946 to date, res. engr. Sask. Dept. of Highways & Transportation, working on road designs, supvrn. of road constrn. and estimates, Saskatoon, Sask. (Jr. 1940).

References: O. W. Martyn, F. H. Smail, E. K. Phillips, W. R. Topham, F. McCallum, G. L. MacKenzie.

RODGER—NORMAN ELLIOT, Major-General, of Ottawa, Ont. Born at Amherst, N.S. Nov. 30th, 1907. Educ.: Graduate, R.M.C., 1928; B.Sc., (Civil), McGill, 1930; with Canadian Army as follows: 1928-29, Engr. Officer; 1930-32, military engrg. and survey courses in England; 1932-33, on survey, Geological Section, General Staff, N.D.H.Q., Ottawa; 1933-37, Staff Officer, General Staff Br., N.D.H.Q., Ottawa; 1937-39, District Engr. Officer, at Calgary, Kingston and Military District No. 3, (eastern Ontario); from 1939 on, service on various staffs and command positions, relating to technical and engrg. fields, particularly during latter stages of last war; at present, Quartermaster-General, responsible for constrn. and mtce. of all Army property and bldgs. (St. 1930, Jr. 1935)...

References: A. G. L. McNaughton, G. Walsh, D. O. Turnbull, L. F. Grant, C. J. MacKenzie, H. W. Love, J. P. Carriere, G. R. Turner.

FOR TRANSFER FROM THE CLASS OF STUDENT

HALL—KENNETH LOGAN, of British Columbia. Born at Eyebrow, Sask. Dec. 16, 1919. Educ.: B. Eng. (Mech.), Saskatchewan, 1946; 1944-45, R.C.E.M.E. Military and Tech. Training as E.M.E. 4th Class; 1945 (4 mos.), Armament Mtce. instructor, Barriefield, Ont.; (3 mos.), Artillery Motor Transport Officer, Fort Sill, Oklahoma, U.S.A.; Oct. 1945-Feb. 1946, Armament Inspection Officer, Esquimalt, B.C.; Feb. 1946-Sept. 1946, Coy. H.Q. Regimental Officer, No. 11 Coy. Vancouver, B.C.; 1946 to date, lubrication engr., McColl Frontenac Oil Co., Vancouber, B.C. (St. 1940).

References: R. A. Spencer, I. M. Fraser, W. E. Lovell, A. L. C. Athkinson, N. B. Hutcheon, E. K. Phillips.,

LIBRARY NOTES (*Continued from page 94*)

ROCK TUNNELING with STEEL SUPPORT:

R. V. Proctor and T. L. White, with an Introduction to Tunnel Geology by K. Terzaghi. Commercial Shearing & Stamping Co., Youngstown, Ohio, 1946. 271 pp., illus., diagrs., charts, tables, 11¾ x 7½ in., cloth, $2.50.

Section I presents the geological information required for estimating the rock pressure on tunnel supports. Section II is devoted to the relationship between rock behavior, type of steel support, and the method of excavation, covering selection and general design of supports. Analytical methods of design of the supporting structure under assumed loading conditions are discussed in Section III. A catalog of the supports manufactured by the company issuing the volume is included as Section IV.

STATISTICAL QUALITY CONTROL:

E. L. Grant. McGraw-Hill Book Co., New York and London; Embassy Bk. Co., Toronto, 1946. 563 pp., illus., diagrs., charts, tables, 9¼ x 6 in., cloth, $5.00.

This book deals with the laws of probability that may be used to improve acceptance procedures and thus secure the best possible quality assurance from a given inspection cost. It explains the Shewhart control chart and its use in manufacturing to reduce costs of spoilage and rework and to obtain better coordination among design, production and inspection. The careful explanation of basic principles is accompanied by many practical examples demonstrating the broad usefulness of quality control techniques in dealing with quality problems in mass production.

TABLES of FRACTIONAL POWERS:

Prepared by the Mathematical Tables Project under the sponsorship of the National Bureau of Standards and the Work Projects Administration for the City of New York and completed with the support of the Office of Scientific Research and Development, I. J. Briggs, Director, and A. N. Lowan. Columbia University Press, New York, 1946. 486 pp., tables, 10¾ x 7¾ in., cloth, $7.50.

The present volume of this steadily expanding series is a compilation of tables of decimal and fractional powers. In Part I the values of Ax, for fixed bases and variable exponents, are given to 15 decimal places for two-digit decimals of A and x. In Part II the function X2, for variable bases and the frequently occurring exponents ±½, ±⅓, ±⅔, ±¼, ±¾, is also tabulated to 15 places. As usual, there is a bibliography of similar tables. In the foreword to the volume various problems are suggested, the solution of which is facilitated by the use of the present tables.

TERMINAL AIRPORT FINANCING and MANAGEMENT:

L. L. Bollinger, A. Passen and R. E. McElfresh. Harvard University, Graduate School of Business Administration, Division of Research, Soldiers Field, Boston 63, Mass., 1946. 385 pp., charts, tables, 8½ x 5¼ in., cloth, $4.25.

Based on an intensive field study of 51 airports and numerous conferences with executives and officials, this book presents the results in four parts: Part I considers public and private financial responsibilities, and develops a proposal for a rate-setting procedure to be used in assessing fair charges against airport users; Part II presents a financial analysis of airport operations based on the actual figures obtained from the airports studied; Part III tests the practicability of the proposed rate-setting formula against the actual operating results reported in Part II; and Part IV is concerned with management, and after a brief discussion of essential airport records, emphasizes the questions of organization, incentives and controls.

WAVE PROPAGATION in PERIODIC STRUCTURES, Electric Filters and Crystal Lattices:

L. Brillouin. McGraw-Hill Book Co., New York and London, Embassy Bk. Co., Toronto, 1946. 247 pp., diagrs., charts, tables, 8½ x 5¼ in., cloth, $4.00.

Based on lectures given at the University of Wisconsin, this volume includes a variety of problems having a common mathematical background. They extend from electrical engineering to electromagnetism and wave mechanics of the spinning electron. The book includes explanations of electric filters, rest-rays, anomalous optical reflection, selective reflection of X-rays or electrons from a crystal, and omission of energy dissipation.

WHAT IS INDUSTRIAL ENGINEERING?

J. D. Woods & Gordon Limited, Industrial Engineers & Consultants, 15 Wellington Street West, Toronto, Canada, 1946. 74 pp., 10¼ x 7 in., paper, gratis.

In a brief, practical manner this book discusses the function of an industrial engineer, which boils down to the study and analysis of a situation as it exists, and the recommendation of procedures for improving the situation under review. This theme is developed under the following headings: business and industrial surveys; selling and marketing analysis; training programs; time and motion study; incentive plans; and personnel work.

NOTICE

The Library of the late I. Leebosh, M.E.I.C. is for sale. Individual items, or the complete collection may be purchased. The list of material available may be consulted at the Institute Library.

Employment Service

The service is operated for the benefit of members of The Engineering Institute of Canada, and for industrial and other organizations employing technically trained men—without charge to either party. It would therefore be particularly appreciated if employers would make the fullest possible use of these facilities to make known their existing or estimated requirements. Notices appearing in the Situations Wanted column will be discontinued after three insertions, and will be re-inserted upon request after a lapse of one month.

Situations Vacant

CHEMICAL

JUNIOR CHEMICAL ENGINEER required for the control department of a paper mill in Shawinigan Falls. Salary from $175-$275. Apply to File No. 3765-V.

JUNIOR CHEMICAL ENGINEER, required by a chemical firm in Shawinigan Falls, Quebec, as assistant to Plant Engineer. Duties include specifications, checking and development of flow sheets. Salary open. Apply to File No. 3769-V.

CIVIL

CIVIL ENGINEER, recent graduate up, required for government organization on West Coast, to carry out field surveys, investigations of water resources and their application and to make reports, maps, plans, etc. Salary $200 up. Apply to File No. 3724-V.

CIVIL ENGINEER, with at least five years' experience, to be assistant to the Director of Community Planning of the Province of Saskatchewan. Starting salary $200-$250. Apply to File No. 3746-V.

CIVIL ENGINEER with experience in survey and construction, preferably bilingual, required to take charge of the engineering department for the woods operations of a paper company in Eastern Quebec. House available. Salary $350 up. Apply to File No. 3749-V.

CIVIL ENGINEER, qualified O.L.S., required as town engineer and superintendent of works for a town in Central Ontario. State age and salary desired. Apply to File No. 3750-V.

GRADUATE CIVIL ENGINEER, required by a public utility in the Montreal area with three or four years' experience in design of reinforced concrete and structural steel. Salary $250-$300. Apply to File No. 3766-V.

GRADUATE CIVIL ENGINEER, required as structural designing engineer by a firm engaged in the manufacture of cranes, crushers, pumps, etc., in the Toronto area. Preferably with 5 to 10 years' experience in designing and detailing steel buildings and bridges. Salary open. Apply to File No. 3771-V.

ELECTRICAL

ELECTRICAL DESIGNING DRAUGHTSMAN with considerable industrial experience and initiative required by an electrical firm in Montreal. Salary open. Apply to File No. 3751-V.

ELECTRICAL ENGINEER with estimating and contract experience, required as office engineer by an electrical firm in Montreal. Salary open. Apply to File No. 3751-V.

ELECTRICAL ENGINEER, recent graduate up, required by a manufacturer in Montreal, for sales engineering. Preferably bilingual and familiar with rotating electrical equipment. Salary $200. up. Apply to File No. 3761-V.

JUNIOR ELECTRICAL ENGINEER, required to act as assistant in an engineering sales office of an electrical firm in the Montreal area. Salary open. Apply to File No. 3768-V.

MECHANICAL

MECHANICAL DESIGN DRAUGHTSMAN with experience in reinforced concrete and structural steel required by a mining company in Northern Ontario. Housing available. Salary open. Apply to File No. 3756-V.

JUNIOR MECHANICAL ENGINEER with industrial experience required as assistant to the plant engineer in a factory in the Montreal area. Salary about $225. Apply to File No. 3758-V.

MECHANICAL ENGINEER, preferably bilingual, with design experience required by a manufacturer in Quebec, for development of new textile machinery. Salary $350-$400. Apply to File No. 3767-V.

GRADUATE MECHANICAL ENGINEER, experienced in boiler operation, required as assistant superintendent on maintenance of railroad and tramways rolling stock, in the Quebec area. Salary $200. per month. Apply to File No. 3772-V.

MISCELLANEOUS

SALES ENGINEER required in the St. John, N.B., district by a firm handling oil purifiers, piston rings and allied engineering products. Salary $250. plus commission. Apply to File No. 3744-V.

TOWNSITE SUPERINTENDENT required for a paper company town in Western Ontario. Salary open. Apply to File No. 3747-V.

GRADUATE ENGINEERS, recent graduates up, preferably mechanical, required for the engineering and operating staff of a pulp mill in Eastern Quebec. Salary open. Apply to File No. 3748-V.

PUBLICITY ENGINEER required by an electrical firm in Montreal to organize publicity department and edit trade journal. Salary open. Apply to File No. 3751-V.

GRADUATE ENGINEER, under 40, with industrial and manufacturing experience and some knowledge of sales, required by a bolt and nut manufacturer in the Montreal area. Salary open. Apply to File No. 3752-V.

GRADUATE ENGINEER required by an insurance company in Montreal for the inspection of boilers, steam plant and allied equipment. Salary from $200. Apply to File No. 3754-V.

JUNIOR DESIGN DRAUGHTSMAN, preferably with heating and ventilating experience, required by a consultant in Montreal. Salary from $175. Apply to File No. 3755-V.

CHIEF DRAUGHTSMAN with experience in Pulp and Paper Mill design wanted immediately in Port Arthur. Reply stating education, experience. Salary open. Apply to File No. 3760-V.

CIVIL, MECHANICAL OR CHEMICAL ENGINEERS, recent graduates up, preferably with experience in petroleum and heavy industry such as chemical or paper, required by an oil company in Toronto. Salary open. Apply to File No. 3762-V.

MECHANICAL OR STRUCTURAL ENGINEER required for the engineering staff of a paper mill in the Ottawa valley. Salary open. Apply to File No. 3763-V.

GRADUATE ENGINEER, with practical experience, production and maintenance, to take charge of Farm Equipment Factory with Grey Iron Foundry, located in Ontario. Apply with photo or snapshot to File No. 3764-V. Salary open.

GRADUATE ELECTRICAL OR MECHANICAL ENGINEER, must have thorough knowledge of fractional H.P. Motors required by a Montreal firm to take charge of small engineering department. Salary $350-$500. Apply to File No. 3770-V.

The following advertisements are reprinted from last month's Journal, having not yet been filled.

CHEMICAL

CHEMICAL ENGINEER OR CHEMIST, preferably with Ph.D., required by a pulp and paper company with plants in Eastern Canada, for research work. Salary open. Apply to File No. 3549-V.

CHEMICAL ENGINEER required by a pulp and paper company with plants in Eastern Canada, for mill control and pilot plant work. Salary open. Apply to File No. 3549-V.

CHEMICAL ENGINEER OR CHEMIST, from recent graduate up, is required by an industrial concern in Montreal for chemical control of products. Salary open. Bilingual preferred. Apply to File No. 3564-V.

CHEMICAL ENGINEER required by a petroleum refining company in Montreal for process and design work. Salary about $225. Apply to File No. 3575-V.

CHEMICAL ENGINEER required as assistant professor of chemical engineering in a Canadian university to start autumn 1947. Salary open. Apply to File No. 3600-V (D).

CHEMICAL ENGINEERS OR CHEMISTS for analytical work in the laboratory of an industrial firm in Central Ontario. Salary from $175. Veteran preferred. Apply to File No. 3642-V.

CHEMICAL ENGINEER, preferably with sales experience, for sales and service with an industrial firm in Central Ontario. Salary open. Apply to File No. 3642-V.

CHEMICAL ENGINEERS, both with experience and recent graduates, required by an industrial organization in the St. Maurice Valley. Salary open. Apply to File No. 3644-V.

CHEMICAL ENGINEER recent graduate up, to be assistant to the department superintendent of a tar distillery in the Toronto area. Salary $225. Apply to File No. 3674-V.

CHEMICAL OR METALLURGICAL ENGINEERS, from recent graduates up, required by a Quebec firm engaged in metal production for employment as production and development engineers. Salaries open. Apply to File No. 3693-V.

CHEMICAL ENGINEER, recent graduate, required as process engineer in production control by a manufacturer in Central Ontario. Salary open. Apply to File No. 3708-V.

CIVIL

CIVIL ENGINEER with experience in the mechanical trades required as designer by a building contractor in Quebec, age 30-35, salary open. Apply to File No. 3444-V.

CIVIL ENGINEER to take charge of work in a drainage district in Quebec. Must be bilingual. May be recent graduate. Salary from $200. Apply to File No. 3479-V.

CIVIL ENGINEER for design work in an industrial plant in the Montreal area with experience in building construction, probably permanent position, salary from $200 up according to experience. Apply File No. 3504-V.

CIVIL ENGINEERS with experience in detailing and designing structural steel and reinforced concrete for manufacturers are required for a steel fabricating company in Manitoba. Salary open. Apply File No. 3519-V.

CIVIL ENGINEERS, recent graduate up, required by a pulp and paper company with plants in Eastern Canada. Salary open. Apply to File No. 3549-V.

CIVIL ENGINEER, age 35-40, with extensive experience in detailing and checking structural steel in buildings and bridges, required by a steel fabricating company in Southern Ontario. Salary open. Apply to File No. 3570-V.

CIVIL ENGINEER, senior designer, experienced in reinforced concrete and structural steel and general building construction, required to take charge of structuraldesign staff for a firm of consulting engineers in Montreal. Salary $300-$400. Apply to File No. 3585-V.

CIVIL ENGINEERS with master's degree, teaching and consulting experience, age 28-40, required for the staff of a university in N.Y. State. Salary open. Apply to File No. 3600-V (C).

CIVIL ENGINEER with construction experience required as plant engineer by a textile firm with headquarters in Montreal. Salary open. Apply to File No. 3615-V.

CIVIL ENGINEER, preferably with railroad experience, required by a company engaged in large scale asbestos production in Quebec to supervise construction of local railroad. Salary open. Apply to File No. 3683-V.

CIVIL ENGINEERS, from recent graduates up, required by a public utility in Toronto for the design and construction of dams, bridges and power houses. Salary open. Apply to File No. 3736-V.

ELECTRICAL

ELECTRICAL ENGINEER, age 32-36, with electrical experience around mines or smelters. English speaking with working knowledge of French, is required by a company in Shawinigan Falls, Quebec. Salary open. Apply to File No. 3415-V.

ELECTRICAL ENGINEER age 30 - 45 with sales training with large manufacturer of electrical equipment instruments and 5-10 years experience as sales service and sales engineer required as sales engineer in Canada for U.S. firm making special equipment for transport and industry. Salary open. Apply to File No. 3447-V.

ELECTRICAL ENGINEER, recent graduate, required for the engineering staff of a paper mill in the Lake St. John area. Salary open. Apply to File No. 3507-V.

ELECTRICAL ENGINEERS, from recent graduates up, required by a company in Montreal engaged in the production of telephone, etc., equipment Veterans preferred. Salary open. Apply to File No. 3551-V.

ELECTRICAL ENGINEER with experience in teaching or practical electrical work required as full-time technical instructor in the Montreal area. Salary open with overtime. Apply to File No. 3600-V. (B).

ELECTRICAL ENGINEER for sales engineering, with previous experience, age 25-40, required by a Montreal firm handling pumps, valves, automatic controls, etc. Salary according to experience. Apply to File No. 3614-V.

ELECTRICAL ENGINEER with knowledge of power apparatus, preferably bilingual, required for sales work with a manufacturer in the Montreal area. Salary open. Apply to File No. 3646-V.

ELECTRICAL ENGINEER with considerable industrial experience required as a safety engineer by a public utility in the Montreal area. Bilingual preferred. Salary open. Apply to File No. 3654-V.

ELECTRICAL ENGINEER to be chief engineer, responsible for electrical and mechanical design and testing, required by a firm in Ontario manufacturing electric motors. Salary open. Apply to File No. 3656-V.

ELECTRICAL ENGINEER with at least three years experience in the design of generating plants and high tension transformer stations required by an engineering firm in Toronto. Salary open. Apply to File No. 3661-V.

ELECTRICAL ENGINEER with several years experience required as a designer by an industrial organization in Montreal. Salary open. Apply to File No. 3677-V.

ELECTRICAL ENGINEER, with general knowledge of a.c. and d.c. motors, switchgear, mercury rectifiers, transformers and other electrical apparatus, for sales work in Eastern Canada, age 30 to 35, salary open. Apply to File No. 3695-V.

ELECTRICAL ENGINEER, recent graduate, preferably bilingual, required by a public utility in the Ottawa area to learn the distribution business from the management end. Salary open. Apply to File No. 3699-V.

ELECTRICAL DRAUGHTSMAN with several years' experience in industrial layouts for large concern in Eastern Townships. Permanent position and attractive salary available for experienced men. Apply to File No. 3701-V.

ELECTRICAL ENGINEER, age about 30, with considerable experience, required by a manufacturer in the St. Maurice Valley. Salary open. Apply to File No. 3723-V.

ELECTRICAL ENGINEERS experienced in the design and installation of private communication systems required for a public utility in Toronto. Salary open. Apply to File No. 3736-V.

ELECTRICAL ENGINEER, with at least five years experience on overhead and underground transmission and distribution systems. Required as distribution engineer by a public utility in Brazil. Salary open. Apply to File No. 3738-V.

ELECTRICAL DESIGNING DRAUGHTSMAN with broad practical experience and theoretical knowledge required for a firm in Quebec. Salary from $225. Apply to File No. 3743-V.

MECHANICAL

MECHANICAL ENGINEER, is required for draughting and detail work with a company in central Ontario. Good prospects for advancement. Single man preferred. Salary open. Apply to File No. 3393-V.

MECHANICAL ENGINEERS, preferably with design experience, are required for armament research and development in the Quebec area, in a government establishment. Salary from $190. Apply to File No. 3401-V.

MECHANICAL ENGINEER, with mine mechanical draughting experience, for producing gold mine in Quebec. Apply to File No. 3436-V, stating experience, references and salary expected.

MECHANICAL ENGINEER with experience in pulp and paper work is required as draughtsman for a company in New Brunswick. Salary is open according to qualifications. Apply to File No. 3471-V.

MECHANICAL ENGINEER with paper mill experience for design and layout in connection with the re-conversion of a paper mill in Eastern Quebec. Salary from $200-$350 according to experience. Apply to File No. 3497-V.

MECHANICAL ENGINEER with experience in pulp and paper or mining work required by a pulp and paper company with plants in Eastern Canada. Salary open. Apply to File No. 3549-V.

MECHANICAL ENGINEER from recent graduates up, preferably with paper and pulp experience, required by a firm in the St. Maurice Valley. Salary according to experience. Apply to File No. 3573-V.

MECHANICAL ENGINEERS to be design squad leaders on heavy machinery design required by a company in Central Ontario. Salary open. Apply to File No. 3623-V.

MECHANICAL ENGINEER recent graduate, required by an industrial firm in south western Quebec, for the design and erection of complex textile machinery. Salary open. Permanent position. Apply to File No. 3625-V.

JUNIOR MECHANICAL ENGINEER with construction or machine shop experience, required in Halifax by a Montreal firm handling heavy construction equipment. Salary open. Apply to File No. 3635-V.

MECHANICAL ENGINEER with experience in machine design required by a firm in the Maritimes engaged in ship repair and conversion and the manufacture of marine and heating equipment. Salary open. Apply to File No. 3638-V.

MECHANICAL ENGINEER with experience in the fabrication of Farm Implements, required by a Quebec firm. Bilingual man preferred. Salary according to experience. Apply to File No. 3666-V.

MECHANICAL ENGINEER with experience in the design of industrial machinery required by a Montreal firm manufacturing custom built machines. Salary $200-$250. Apply to File No. 3669-V.

MECHANICAL ENGINEER with design experience in the pulp and paper industry required by a firm with headquarters in Montreal. Salary $350. Apply to File No. 3673-V.

JUNIOR MECHANICAL ENGINEER with knowledge of precision machine shop practice and aptitude for research work in metals and plastics required for an organization in Toronto for the production of artificial limbs. Must be veteran. Salary from $225. Apply to File No. 3675-V.

MECHANICAL ENGINEER with industrial or construction experience, required by a firm of consulting engineers to inspect machinery deliveries in the Cornwall area. Salary open. Apply to File No. 3691-V.

MECHANICAL ENGINEER, recent graduate up, required for maintenance and production engineering by an industria firm in Montreal. Salary open. Apply to File No. 3692-V.

MECHANICAL ENGINEERS, age 25-35, required by a manufacturer in Montreal, for training as sales engineers and for executive positions. Salary from $200. Apply to File No. 3710-V.

JUNIOR MECHANICAL ENGINEER, under 30 and preferably bilingual, required by a Montreal firm to train as sales engineer for pumps, engines and allied electrical equipment. Salary open. Apply to File No. 3714-V.

MECHANICAL ENGINEER, under 45, with at least ten years' experience in design of heating, ventilating and refrigeration layouts, required as heating engineer for a government organization on West Coast. Salary $250-300. Apply to File No. 3724-V.

YOUNG MECHANICAL ENGINEERS, with practical experience either in automotive or general manufacturing industries, together with ability to operate engineering office systems, required by an industrial organization in Ontario. Salary open. Apply to File No. 3732-V.

MECHANICAL ENGINEERS, with at least five years' experience in the Pulp and Paper industry required by an Ontario Paper Company. Salary open. Apply to File No. 3733-V.

SENIOR MECHANICAL ENGINEER, ten to fifteen years' experience required by a West Coast manufacturer of heavy equipment and vehicles to take charge of engineering design and inspection departments. Salary about $350. Apply to File No. 3734-V.

MECHANICAL ENGINEERS, with experience in plant layouts and design or ventilation problems or general mechanical design, required by a firm in Quebec. Salary from $250. Apply to File No. 3743-V.

MINING

MINING ENGINEER with several years experience required by a company engaged in large scale asbestos production in Quebec. Salary open. Apply to File No. 3683-V.

MINING ENGINEERS, with varied experience required by a firm in Quebec for general mine operation, exploitation and development work. Salary from $250. Apply to File No. 3743-V.

MISCELLANEOUS

MANAGEMENT ENGINEER with business administration and mechanical background, age 30 up, bilingual with at least 5 years practical experience, required by an industrial engineering consultant in Montreal. Apply to File No. 3307-V.

CIVIL OR MECHANICAL ENGINEER with experience in pulp and paper mills, to be assistant to plant engineer in a paper mill in Central Quebec. Salary open. Apply to File No. 3445-V.

TWO STRUCTURAL STEEL DRAUGHTSMEN with five or more years experience in designing and detailing steel structures. State experience and salary required. Location Toronto. Apply to File No. 3451-V.

MECHANICAL OR ELECTRICAL ENGINEER with experience in paper mill or steam plant operation, bilingual if possible, is required by an industrial firm near Montreal. Salary from $300, according to experience. Apply to File No. 3498-V.

STRUCTURAL STEEL DRAUGHTSMEN AND CHECKERS, preferably graduate engineers but any experienced men acceptable, are required for a steel fabricating company in Manitoba. Salary open. Apply to File No. 3519-V.

MECHANICAL OR MINING ENGINEER, age 30-40 with experience in industrial engineering, required by a large mining and processing firm for methods studies of equipment, labour and costs. Salary according to qualifications. Apply to File No. 3524-V.

ASSISTANT PLANT ENGINEER with paper mill experience required by a pulp and paper company with plants in Eastern Canada. Salary open. Apply to File No. 3549-V.

GRADUATE ENGINEERS with experience in air-conditioning, heating, refrigeration and allied problems, required by a manufacturer in the Montreal area. Salary open. Apply to File No. 3566-V.

DESIGN ENGINEER with considerable experience required by a pulp and paper firm in the St. Maurice Valley. Salary open. Apply to File No. 3573-V.

CIVIL AND MECHANICAL ENGINEERS AND DRAUGHTSMEN, preferably experienced in building design and plant layout, required for a pulp and paper mill in Southern Ontario. Salary open. Apply to File No. 3578-V.

GRADUATE ENGINEERS, required by a large industrial and chemical organization with headquarters in Montreal for all phases of research design, operation, development, production and maintenance. Salaries open. Apply to File No. 3588-V.

ASSISTANT PROFESSORS AND INSTRUCTORS required for the staff of a technical college in New York State. Salary open. Apply to File No. 3600-V. (A)

DESIGN ENGINEERS with experience in reinforced concrete and hydraulic structures for hydro-electric developments for an engineering firm with headquarters in Toronto. Salary open. Apply to File No. 3612-V.

CHIEF ENGINEER with industrial experience required for a steel fabricating plant in Western Canada. Salary open. Apply to File No. 3616-V.

STRUCTURAL OR MECHANICAL DRAUGHTSMAN required for detail drawings by a steel fabricating plant in Western Canada. Salary open. Apply to File No. 3616-V.

SALES AND SERVICE ENGINEER with considerable experience in sales and heavy mechanical equipment required by a sales organization on the West Coast. Salary open. Apply to File No. 3626-V.

DESIGN DRAUGHTSMAN for the design of cranes and hoists of all types, capable of making and checking complete manufacturing detail drawing, required by a manufacturer in Southern Ontario. Apply to File No. 3628-V by letter with full details. Salary open.

SALES ENGINEER with wide engineering experience wanted by a company in Toronto for the sale of textile machinery and construction equipment. Salary open. Apply to File No. 3639-V.

MECHANICAL AND STRUCTURAL DESIGNERS AND DRAUGHTSMEN required by a pulp and paper company in the Port Arthur district. Salary open. Apply to File No. 3653-V.

ASSISTANT ENGINEER with experience in estimates and specifications for industrial work required by a pulp and paper company in the Port Arthur district. Salary open. Apply to File No. 3653-V.

CHIEF DRAUGHTSMAN with at least five years draughting room and related engineering office experience, preferably in pulp and paper or process industries, required by a pulp and paper mill in the Port Arthur district. Salary open. Apply to File No. 3653-V.

CIVIL OR MECHANICAL ENGINEER, required by a pulp and paper company in Newfoundland to look after new development work and general engineering in connection with woods operations. Salary open. Apply to File No. 3655-V.

ASSISTANT PLANT ENGINEER, preferably with pulp and paper or structural design experience, required for a newsprint mill in a city on north shore of Lake Superior. Salary open. Apply to File No. 3657-V.

JUNIOR ELECTRICAL OR MECHANICAL ENGINEER required by an industrial firm in Montreal for training as an industrial engineer, including plant layout and maintenance. Salary open. Apply to File No. 3660-V.

MECHANICAL OR ELECTRICAL ENGINEERS for training as production engineers with an industrial firm in Montreal. Salary open. Apply to File No. 3662-V.

CONSTRUCTION ENGINEER with ten years' experience in the design and erection of steel and concrete buildings required for the staff of an oil company in Montreal. Travelling involved. Salary open. Apply to File No. 3663-V.

JUNIOR ENGINEERS preferably with pulp and paper or other industrial experience required for training for the sales staff of a Montreal manufacturer of machines and equipment. Salary from $175. Apply to File No. 3664-V.

GRADUATE ENGINEERS for mechanical design, experimental, test and development departments of a Canadian firm producing aircraft gas turbines. Salary open. Apply to File No. 3667-V.

STRUCTURAL DESIGNERS AND DRAUGHTSMEN required by a firm of consulting engineers in Montreal. Salary open. Apply to File No. 3668-V.

JUNIOR ENGINEERS, recent graduates up, as designing draughtsmen for a brewing company with headquarters in Montreal. Salary from $200. Apply to File No. 3670-V.

SALES ENGINEER with knowledge of sawmill and woodworking equipment, preferably bilingual, required for the sale of specialized equipment. Salary $200 plus commission. Apply to File No. 3678-V.

INDUSTRIAL ENGINEER as field representative in the Toronto-Niagara area for a government department, five to ten years experience. Salary about $300. Apply to File No. 3682-V.

JUNIOR ENGINEER, recent graduate up, required as surveyor by a company engaged in large scale asbestos production in Quebec. Salary open. Apply to File No. 3683-V.

CIVIL OR MECHANICAL ENGINEERS, recent graduates, required by major oil company engineering Dept. Work consists of design of buildings and miscellaneous equipment for handling petroleum products. Salary open. Apply to File No. 3685-V.

CIVIL OR MECHANICAL ENGINEER, experienced in design and field supervision of construction of industrial buildings, piping, pumping and mechanical equipment, for products distribution of major oil company. Ten years experience required. Salary open. Apply to File No. 3685-V.

STRUCTURAL STEEL CHECKER OR DRAUGHTSMAN required immediately for a steel fabricating company in Niagara Peninsula. Salary open. Apply to File No. 3687-V.

MECHANICAL OR ELECTRICAL ENGINEER with general industrial experience, preferably with knowledge of time study, required by a wire and cable manufacturing company in Ontario. Salary approximately $225, depending on qualifications. Apply to File No. 3690-V.

JUNIOR CIVIL OR MECHANICAL ENGINEERS with design or structural experience required by a manufacturer of contractors' equipment in the Hamilton area. Salary open. Apply to File No. 3698-V.

CONSTRUCTION ENGINEER with field experience, age about 30, required as office engineer and assistant to general manager for a firm of contractors in Montreal. Salary open. Apply to File No. 3703-V.

CIVIL OR MECHANICAL ENGINEER with considerable experience in the design and layout of industrial plants required for the design staff of an industrial organization in Montreal. Salary from $250. Apply to File No. 3704-V.

SPECTROSCOPIST with experience in chemical analytical work and the use of the commission spectograph required by an industrial organization with headquarters in Montreal. Salary open. Apply to File No. 3706-V.

FORESTRY ENGINEER, recent graduate up, required by a paper company for woods operations on the Lower St. Lawrence. Salary from $175. Apply to File No. 3707-V.

CHEMICAL, MECHANICAL OR METALLURGICAL ENGINEER, recent graduate up, required by a manufacturer in Central Ontario for construction project work from inception to completion as required. Salary from $200. Apply to File No. 3708-V.

JUNIOR SALES ENGINEER, mechanical background, age 25-30, required by a Montreal firm manufacturing steel tanks, oil drums and other equipment for the oil industry. Salary about $200. Bilingual an advantage. Apply to File No. 3709-V.

JUNIOR ENGINEER DRAUGHTSMAN required by a Montreal firm designing and manufacturing aeroplane equipment. Salary open. Apply to File No. 3712-V.

JUNIOR ENGINEERS, recent graduate up, required for the engineering staff of a communications company with headquarters in Montreal. Veterans preferred. Salary from $175. Apply to File No. 3713-V.

JUNIOR STRUCTURAL DESIGN ENGINEER required by a steel fabricating firm in Central Ontario. Salary open. Apply to File No. 3715-V.

JUNIOR ENGINEERS, preferably with some mechanical design experience, required for the engineering staff of a manufacturer in Sherbrooke. Salary open. Apply to File No. 3721-V.

JUNIOR ENGINEERS, recent graduates up, with mechanical background required by a Montreal manufacturer for the design and supervision of boiler plant installations, preferably bilingual. May have sales work. Salary from $200. Apply to File No. 3722-V.

MINING AND METALLURGICAL ENGINEER, age about 30, with considerable experience, required by a manufacturer in the St. Maurice Valley. Salary open. Apply to File No. 3723-V.

CONSTRUCTION ENGINEER with considerable experience required for the permanent staff of a Montreal inspection company. Salary about $200. Age immaterial. Apply to File No. 3728-V.

JUNIOR ENGINEER, preferably with experience in heating and combustion problems, required by a specialist firm in Montreal. Salary $250-325. Apply to File No. 3729-V.

PLANT ENGINEER, age about 35, with factory experience and mechanical background, including maintenance and power plants, steam and electrical, required by a manufacturer in Montreal. Salary from $350. Apply to File No. 3735-V.

SALES ENGINEERS, with mechanical background, bilingual, required by a Montreal firm handling road building and contractors equipment, generators, pumps, etc. Salary open. Apply to File No. 3737-V.

DETAILER AND DESIGNER for reinforcing steel with considerable experience required by a steel fabricating firm in Montreal. Salary open. Apply to File No. 3740-V.

STRUCTURAL STEEL DETAILER AND CHECKER with considerable experience required for checking shop details by a steel fabricating firm in Montreal. Salary open. Apply to File No. 3740-V.

DESIGN ENGINEERS, age about 30, with experience in the design and layout of chemical plants, required by an industrial organization in the St. Maurice Valley. Salary from $250. Apply to File No. 3741-V.

DESIGN DRAUGHTSMEN, age about 25, with experience in chemical plant layouts, required by an industrial organization in the St. Maurice Valley. Salary from $200. Apply to File No. 3741-V.

INDUSTRIAL ENGINEER, with broad experience in plant development, operation, costs and management required for a firm in Quebec. Salary from $250. Apply to File No. 3743-V.

SALES ENGINEER, preferably bilingual, required by a Montreal firm dealing in building materials. Salary from $200. Apply to File No. 3745-V.

SUMMER EMPLOYMENT . . . WANTED

The Employment Service of the Engineering Institute is endeavouring to aid their Student members to obtain suitable practical experience during the summer months. We would appreciate any assistance from firms anticipating such openings.

HEADQUARTERS OF THE ENGINEERING INSTITUTE OF CANADA

requires

ASSISTANT GENERAL SECRETARY *and* TECHNICAL EDITOR

ASSISTANT GENERAL SECRETARY to have charge of staff, to assist Institute committees in secretarial capacity, to have general supervision over Engineering Journal on behalf of Publication Committee, and in general to assist General Secretary in all duties. Travelling will be required. Must be a professional engineer and preference will be given to a member of the Institute.

TECHNICAL EDITOR to take full charge and responsibility under the Publication Committee, for all material in the Journal, with the exception of editorials and advertising. Required to appraise and edit manuscripts, prepare articles and seek out suitable papers that might not otherwise be obtained. Some travelling will be required. Appointment on a full time basis preferred but consideration will be given to a part time appointment.

Applicants are requested to communicate with the GENERAL SECRETARY, HEADQUARTERS, THE ENGINEERING INSTITUTE OF CANADA. All applications will be submitted to the Finance Committee for selection and recommendation to Council.

Civil Engineer

GRADUATE CIVIL ENGINEER required for structural design work by an established firm of consulting engineers in Toronto. The applicant should preferably be experienced in the construction and design of both structural steel and reinforced concrete structures. The application should contain a list of experience from date of graduation. All replies to this advertisement will be answered. Apply File No. 3753-V.

Technical Graduate

Preferably Mechanical, Chemical or Electrical, under 30, returned from military service, for permanent position with engineering organization doing business throughout Canada. After a training period in the United States, work will include travelling for consultation among leading industrial plants. Opportunity for advancement. Enclose photo when answering. Apply to File No. 3759-V.

Situations Wanted

GRADUATE CIVIL ENGINEER, M.E.I.C., P.E.Q., 20 years work on Hydraulic Plants as designer and superintendent of construction. Extensive experience in guniting, diamond drilling and pressure grouting. One month notice. Apply to File No. 1527-W.

CIVIL ENGINEER, Jr. E.I.C., P.Eng., McGill, 30 years of age, bilingual, ex-R.C.E. officer, 3 years' experience on construction, 2 years pulp and paper industry, 1 year with public utility firm, administrative and contact ability, seeking permanent position. Available on short notice. Apply to File No. 1552-W.

GRADUATE ENGINEER, M.E.I.C., member of Board of Trade, Corporation of Professional Engineers, age 33. Interested in: Consultation, analyzing problems, constructive planning, programming projects and over-all direction. Have had real experience and responsibilities in executive planning, inspection and supervision in industry, scheduling, control, costing, promoting production, customer satisfaction, technical sales. Apply to File No. 2441-W.

PART TIME WORK—YOUNG CIVIL ENGINEER, S.E.I.C., would accept some work at night or during spare time; at office or at home. Now engaged in design work during day-time. Apply to File No. 2735-W.

CIVIL ENGINEER, B.A., B.Sc., M.E.I.C., R.P.E., age 44, with over 20 years' experience in railway, municipal and highway engineering, also consultative, including design, location, construction and maintenance. Extensive administrative and executive experience. Desires position in construction engineering or superintendent for construction firm. Apply to File No. 2808-W.

ELECTRICAL ENGINEER, Jr. E.I.C., age 34, R.P.E., Ont., on University staff, with sales, maintenance and switchboard design experience. Desires summer employment. Apply to File No. 2809-W.

GRADUATE ENGINEER, mining, Jr. E.I.C., R.P.E., Ont., age 31, married. Approximately three years' experience in mine and land surveying, and three years as a supervisor in production, development and process control in heavy industry. Presently employed, but interested in a position with Consulting Engineer, Surveyor, or in Production. Location preference: Ottawa or Toronto areas. Apply to File No. 2810-W.

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CONTENTS

COVER PICTURE

March 3rd marks the 100th anniversary of the birth of Alexander Graham Bell, the inventor of the telephone. Bell had a summer home near Baddeck, N.S. The cover picture, taken in his laboratory there, is a study of Mr. Bell in later life. He spent many hundred "man-hours" of his time just this way—tabulating statistics concerning the deaf. The number of congenitally deaf children born of congenitally deaf parents worried him so greatly that at one time he produced a "Memoir upon the Formation of a Deaf Variety of the Human Race".

CANADA'S SYNTHETIC RUBBER PRODUCTION

GORDON R. HENDERSON, M.E.I.C.
Chief Engineer, Polymer Corporation Limited, Sarnia, Ont.

A paper presented before the Montreal Branch of The Engineering Institute of Canada, December 12th, 1946.

The author traces the early developments in synthetic rubber production in Germany and America, and describes the evolution of butadiene from the oil industry. The tie-in between the Polymer plant and the Imperial Oil refinery is outlined and the manufacturing process described. Details of the utility requirements are given. The methods of separating and treating the gaseous products are dealt with. Safety measures and plant control are discussed.

The Baruch Report on the rubber situation as presented to the President of the United States in 1942, prefaced its findings by the following statement:

> Of all critical and strategic materials, rubber is the one which presents the greatest threat to the safety of our nation and the success of the allied cause. Production of steel, copper, aluminum alloys or aviation gasoline may be inadequate to prosecute the war as rapidly and effectively as we could wish, but at the worst, we are still assured of sufficient supplies of these items to operate our forces on a very powerful scale. But, if we fail to secure quickly a large new rubber supply, our war effort and our domestic economy both will collapse.

The above statement is undoubtedly familiar to all of us. The subsequent result is even more familiar, because the war was prosecuted and won by huge armies adequately supplied with all necessary materials, and our domestic transportation did not suffer from any crippling shortage of tires. Moreover, the production of synthetic rubber in huge quantities is a real contribution to the present slow but sure return to normal conditions throughout the world today.

The production of large quantities of synthetic rubber was not a question of waving a magic wand. It was the result of years of development and research by the industries that combined to make the development possible, namely, the rubber manufacturers, the chemical producers and the oil industry. Before outlining a few of the problems which confront the engineer in the production of synthetic rubber, it is profitable to review briefly the events which made the programme possible, and thus gain a clearer understanding of the type of equipment in use at Sarnia.

Prewar Synthetic Production

A great number of rubber-like synthetics have been produced from a great variety of raw materials. It is an old adage that "necessity is the mother of invention". In consequence, the development of a satisfactory rubber-like synthetic was first announced by the German I. G. Farbenindustrie. During the last war the German army had been seriously handicapped by the lack of rubber, and this commodity was essential for the successful prosecution of another war. The Buna-S and Buna-N produced there were both developed from the reactive hydrocarbon acetylene made from the limestone and coal, both of which are found in great abundance in Germany. The development can be considered natural in a country which has a very limited supply of hydrocarbon in the form of crude oil.

On this continent, the necessity for a rubber-like material was not considered essential for national existence, but the variation in cost of rubber during the past thirty years fostered a constant research programme. It is somewhat ludicrous to recall that the Dupont Chemical Co. priced their synthetic neoprene at $1.05 per lb. in 1931, when natural rubber sank to its all-time low of 3½c per lb. Neoprene is made by the polymerization of chloroprene, which is in turn prepared by adding chlorine to the hydrocarbon isoprene. Regardless of the price differential, the new synthetic lived, and its sales increased rapidly.

During the next ten years many new synthetics were placed on the market. Their trade names are now well known: Buna-N, Thiokol, Vistanex, Flamenol, Pliofilm, Koroseal, and a host of others. However, none of these materials was satisfactory as tire rubbers, although they had characteristics very desirable in other fields. When the supply of natural rubber disappeared with the Japanese conquest of Malaya early in 1942, it was realized that the most suitable tire rubber was Buna-S, prepared by the copolymerization of butadiene and styrene.

"Polymerization" can be defined as the means of joining molecules of the same compound to form a new substance of higher molecular weight and of different physical characteristics. In the reactions considered here it is a linkage of hydrocarbon molecules, for all the world like a chain of paper clips linked end to end. Estimates of the number of isoprene molecules in natural rubber ranges from 200 to 4000.

War Made Synthetic a Necessity

Some of the rubber manufacturers had carried on exhaustive research for the preparation of the buna-S type rubber through the 1930's, and when war broke out there were two semi-commercial plants in the process of design and construction. Moreover, the Dow Chemical Co. of Midland, Michigan, had developed a process for the production of styrene, essentially as a thermal plastic, and a small commercial plant was put into operation in 1938.

The problem of expanding both the Buna-S and styrene plants from semi-commercial production to enormous commercial output, was a major undertaking. The production of butadiene, which is equivalent to approximately 75 per cent of the required material, without even pilot plant work, was an unprecedented task. Two methods were practical, one using alcohol as the primary material, and the second by dehydrogenation of the normal butylene, which is present in sizeable quantities from the gases produced in oil refinery cracking operation.

Chemical manufacturers of carbon and carbide produced butadiene from alcohol in a surprisingly short period of time. This material provided feedstock for the first synthetic rubber produced on a major scale during the war. However, it was realized when the programme was commenced, that butadiene from alcohol would cost considerably more than that from petroleum, roughly 40c per lb., as compared to 10c per lb. In consequence, its manufacture was stopped

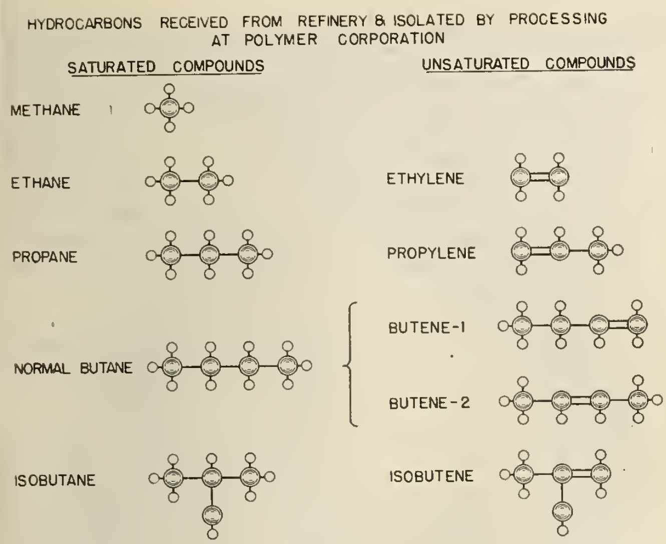


Fig. 1

shortly after Japan capitulated, with the exception of those plants retained for development purposes.

The government-owned plant at Sarnia is designed to extract butylene from the gas stream produced by the cracking operations at the adjacent Imperial Oil refinery. Polymer is the only plant which combines all operations to produce the two major synthetics used in tire manufacture, namely, Buna-S now called GR-S (Government Rubber Styrene), and Butyl GR-I (Government Rubber Isobutylene).

How Butadiene Was Evolved from Gasoline Industry

Let us look for a moment at the transition through which the oil industry passed in the nineteen twenties and thirties, that led up to their ability to produce butadiene.

The plant at Sarnia may be considered as a tangible result of development and progress in the gasoline industry during the twenty odd years preceding the outbreak of war. During this time the improvement in quality of gasoline, and the increase in percentage of this product obtained from a barrel of crude oil, was accomplished by the cracking or breaking down of heavy complex hydrocarbons to the simpler forms which are present in the gasoline boiling range.

The " octane " race of the twenties and the thirties was induced by a highly competitive automotive industry which increased cylinder compression ratios to decrease engine weights and improve the performance of the internal combustion engine. All of this resulted in lower costs per horsepower. But each new car design forced the refiner toward more severe cracking conditions (that is, increased temperature and pressure) to meet the higher gasoline specifications demanded by new engines. Unfortunately, the cracking plant losses by the formation of non-condensible gases increased along with the specification. In consequence the refiner turned his attention toward the utilization of the materials contained in the gas stream.

It was readily recognized that if the gaseous hydrocarbons could be combined, a heavier product would be produced as a liquid in the gasoline range. Therefore, if two molecules, each containing four carbon atoms, could be joined together (synthesized), iso-octane would be produced, which could be used to increase the anti-knock qualities of base stock gasoline. About 1935 this reaction was accomplished by a number of processes, both thermal and catalytic, and over the next few years the industry learned a great deal about catalytic synthesis.

It is well to recognize here that the treatment of the gaseous portion of the hydrocarbon stream introduced new problems into an already complicated industry. The equipment manufacturers were called upon to meet the new demands, and if time would permit it would be interesting to review the changes that took place during this period.

Up until the outbreak of the European war, the plants that were designed to utilize the hydrocarbon gases were relatively small and few in number. Polymerization and alkylation plants were added to existing refineries, and their products supplied a considerable portion of the aviation gasoline requirements. But, even this was soon recognized as being insufficient to meet the increasing demand of the airplane. Only those hydrocarbons which are deficient in hydrogen (that is, unsaturated) were reactive enough to be utilized. The balance of the C4 or butane stream, which was about 65 per cent of the total, provided additional potentialities for high octane blending stock. Considerable research work was conducted to develop the technique of removing hydrogen from saturated butane. By the time Japan attacked Pearl Harbour, the reaction was fundamentally understood, and at least one plant had been placed in commercial production.

The foregoing sequence of events gave the research chemists and process engineers a general understanding of the technique required to dehydrogenate butylene to butadiene, or to produce a double dehydrogenation from butane to butylene to butadiene. At the same time, the industry increased its knowledge of fractionation to a point where the isolation of individual hydrocarbon monomers had progressed from the laboratory to commercial processes.

How Polymer Is Geared to Imperial Refinery

The Polymer plant at Sarnia commences where the refiner leaves off. Although the materials used are any but waste products, the operation is complementary to the refinery. The gaseous product from the neighbouring Imperial refinery is delivered to first fractionation unit. There it is separated into its various components by means of fractionating equipment, and temperatures in this plant range from —120 to 250 deg. F. with pressures up to 480 lb. per sq. in. gauge. Here ethylene is extracted for styrene manufacture. This material is used both as a major constituent of Buna-S rubber and also as a thermal plastic. It is

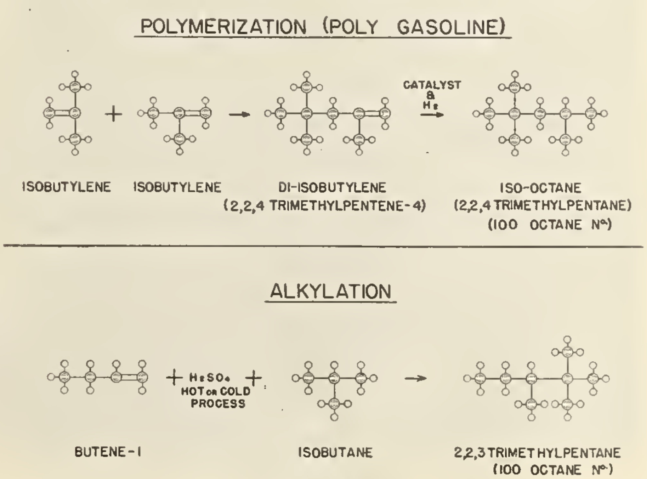


Fig. 2

Fig. 3—Light ends fractionating unit.

anticipated that within the next year a portion of the ethylene will also be used for the manufacture of ethylene glycol.

The only other hydrocarbon contained in the gas stream which is utilized in the manufacture of rubber is contained in the butane or C4 cut, taken as overhead from the top of the debutanizer column. In the processes at Sarnia, only the unsaturated or olefinic forms of the C4 cut are used. After the butanes are isolated however, they are fed into the second unit where isobutylene is extracted from the C4's by dissolving this material from the stream with sulphuric acid. The isobutylene fraction is removed from the normal butylenes in order to prevent dilution in the butadiene dehydrogenation plant. Since isobutylene is thus made available, Sarnia installed the butyl rubber plant, designed to produce butyl rubber by the polymerization of isobutylene.

Manufacturing Process Described

This butyl rubber reaction takes place in a vertical tubular reactor at —140 deg. F. where it is contacted with a liquid catalyst. Both the feed stream and the catalyst stream are dried through alumina driers. Next they are precooled to the desired temperature, before being injected into the bottom of the reactor. The temperature is obtained by using conventional compressor refrigeration systems with ammonia and

Fig. 4—Panorama of operating units. Butyl rubber unit, right centre.

ethylene as refrigerants. The unused portion of the gases are flashed off immediately after the reaction, and recycled through the plant. The solid butyl rubber which is formed in the reactor, is transported by a water stream to the finishing section. There the butyl rubber is very thoroughly dried and worked at a temperature of about 300 deg. F. through extruders and milling machines, before being cut into strips for packaging. This material is an excellent gas container, and has been the source of all inner tubes in Canada during the past 18 months.

The residual stream from the isobutylene extraction plant is composed of butane, isobutane, and normal butylenes. The latter monomer is removed from the stream by extractive distillation, using acetone as a solvent. The butylenes are fed into the dehydrogenation unit. Butylene dehydrogenation is accomplished by feeding a mixture containing approximately twenty volumes of steam to one volume of butylene at a temperature of approximately 1100 deg. F. The mixture passes through a fixed bed catalyst at a nominal pressure of five to ten pounds. Here, hydrogen is released from the butylene, and carbon is deposited upon the catalyst bed. It is therefore necessary to regenerate the catalyst by burning off the carbon at periodic intervals. The normal cycle is about 60

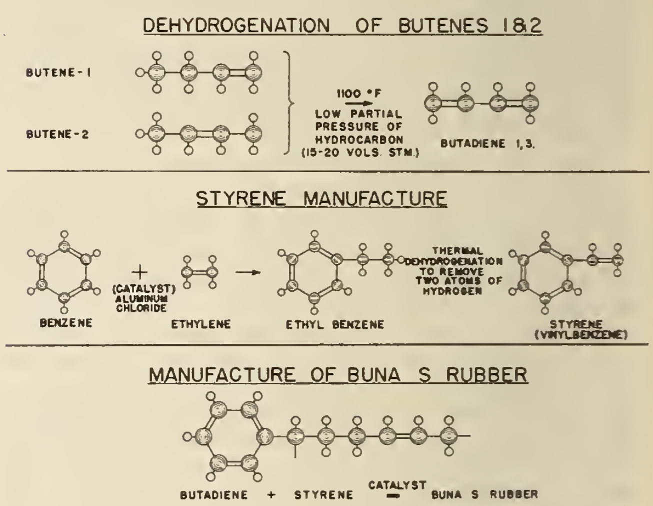


Fig. 5

minutes, and an automatic time-cycle controller operates the necessary valves to change reactors each hour during the operation.

The outlet from the reactors themselves is a mixture of steam, and gases, which are a combination of virtually all materials in cracking reaction. These latter have to be separated by normal fractionation. But before doing so the temperature must be reduced from 1100 to something around 100 deg. F. Fractionation is accomplished in a liquid phase, so that gases are compressed to normal fractionating pressures and condensed to their liquid form. The resulting product from the butadiene plant contains in the neighbourhood of 20 per cent butadiene in a mixture of C4 materials, and as the boiling points differ by only about 5 deg. F., it is necessary to isolate the butadiene content. This is done by dissolving the material in a copper ammonia solution, to obtain the high degree of purity necessary for the Buna-S reaction.

Styrene is made in the section of the plant operated by the Dow Chemical Company, by mixing ethylene from the light ends plant with imported benzol. The combination of these two substances is carried out in

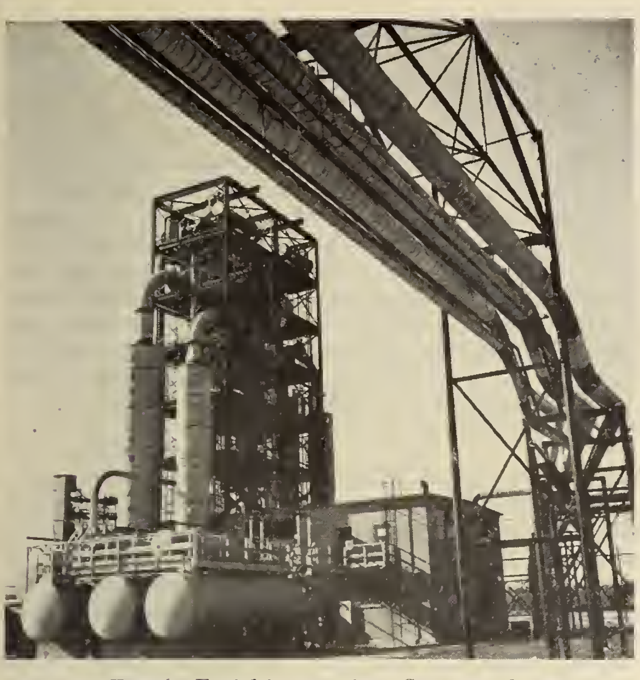


Fig. 6—Finishing section. Styrene plant.

the presence of a liquid catalyst. The resulting main product from this unit, ethylbenzene, is then passed through a fixed bed catalyst reactor in the presence of high temperature steam (1500 deg. F) where it is dehydrogenated. The resulting styrene is then concentrated to a very high purity 99.6 per cent by vacuum distillation. (Fig. 5).

These two main components of buna-S rubber (butadiene and styrene) are charged to glass-lined reactors in the synthetic rubber plant. Here the reaction is controlled in the presence of a soap solution emulsifier, antioxidant and modifier, to produce a heavy milk-like latex over a period of 13 to 16 hours. Although the reaction was originally designed as batch process, it has been possible to arrange continuous reaction by joining 12 reactors in one line. Resulting latex contains about 28 per cent solids, and a considerable portion of unused gas butadiene and styrene. These latter materials are recovered in a distillation section, and the gases are returned to the front end of the plant for recycle. (Fig. 5).

The stripped latex is delivered to storage tanks in the finishing building. It is kept constantly agitated and under inert gas blanket to stop additional polymerization. Finally, the latex is fed through a coagulation trough. The solids are here separated out by coagulation with salt and acid, or alum, or salt alone, depending upon requirements of the rubber companies. The solution is removed from the solid material by screens or Dorr skimmers. They are then transported by water to Oliver filters, where the cake is washed, and finally delivered to large steam-heated driers. This material is shipped by compressing it under hydraulic pressure to a 75 lb. bale.

Utility Requirements

The steam and water requirements of the plant were somewhat overestimated, but even present day normal consumption of these is very large, with a steam production of over 800,000 lb. per hour and a cooling water consumption which totals approximately 85,000 U.S. gal. per min. during the summer season. Seven different types of fuel are used in the plant, but six of these are either used for economic convenience or as emergency generation. The basic fuel is mine-run coal, burned as pulverized fuel.

The annual coal consumption exceeds three hundred thousand tons. Coal is brought to the site by self-unloading lake freighters, which discharge their cargo at the rate of about 1,000 tons an hour. The coal is delivered to the pile by conveyor belt, and dumped off the end of a boom conveyor. During the summer, a portion of the coal is fed directly to the primary crushers by caterpillar tractors, and the balance stockpiled by Letourneau drag scrapers. This equipment has proved very satisfactory. Even distribution and adequate compacting have eliminated any tendency toward overheating. The maximum temperature recorded in the pile, which averages 250,000 tons at the beginning of winter, is 115 deg., and no fires of any description have ever occurred.

In order to obtain delivery of small process electrical equipment in the shortest period of time during the war emergency, it was necessary to use a frequency of 60 cycles. Consequently generating equipment had to be installed in the power plant. Although the turbo-generators used for this service were second-hand condensing machines, it was recognized that an economic power supply could be generated by the use of extraction turbines. It is expected that this type of generating equipment will be installed during 1947, and that all power needed to operate the plant will be provided in this manner. Although the steam and power plant is the largest unit of its kind in Canada, with five boilers, each rated at 300,000 lb. per hour, and an installed generating capacity of 25,000 kw, it is only briefly referred to here, as the subject under discussion is the manufacture of synthetic rubber.

Gaseous Products

One of the major problems of both design and

Fig. 7—Reactors for GR-S rubber.

operation of the plant is that a daily maximum of 19,000,000 cu. ft. of gas, and over 6,000 bbl. of light hydrocarbons have to be processed continuously. It is not economically feasible to provide any storage capacity, either in feed streams from the refinery to the rubber plant, or the return fuel gas line which is indispensable for uninterrupted operation of the system. Coordinated operation, and the continuous satisfactory performance of control instruments, are an absolute necessity to assure uninterrupted production. In addition, all materials passing between the two plants must be measured, sampled, and analysed, to assure adequate control of the mechanics of buying and selling.

Furthermore, it is now the intention to sell gaseous products from the gas fractionating plants in the Polymer operation, to a large chemical industry. This will increase the number of problems for the engineers, although no undue difficulty is foreseen. The eventual layout of the Sarnia area indicates what can be accomplished by coordinated effort on the part of industries of this nature.

The first operation in the sequence of isolating the individual hydrocarbons is to remove the hydrogen-sulphide, because large quantities of fuel gas are utilized in the operation of the 15,000 hp. gas driven compressors required in the various processes. Normally, it would be possible to caustic-wash the products only, but general operations dictated the necessity of treating the entire feedstock.

One of the most important and interesting developments, has been that of reducing the leakage of highly volatile and/or toxic liquids during pumping operations. Virtually every conceivable application may be found in the plant, including the conventional packing, the dry mechanical seal, single liquid seals, double liquid seals. It is now the intention to use as well an application of the packless pump on ethylene product service. This latter unit comprises a motor running in a sealed casing filled with oil, and having a mechanical seal between the motor and pump. The pressure maintained on the oil is somewhat higher than the product pumped, and therefore there is a slight leakage into the product. A balance chamber is provided between the product on one side of a diaphram, and the oil on the other. This application is being used because of the value of the material produced, and the high reflux rate at which the fractionating system must operate.

Fig. 8—Fuel gas driven compressors. Butyl rubber plant.

This comparatively new industry uses for the first time large quantities of di-olefins. These are hydrocarbons which are deficient in two hydrogen molecules, and are therefore doubly reactive. Although the final plant products are obtained by polymerization, it becomes most embarrassing when this reaction occurs at times when it is not supposed to. The formation of "popcorn polymer" has been a perplexing phenomena and one of the headaches to both the operator and the maintenance engineer. Condenser shells begin to enlarge and when taken out of service the material in the shell can be heard to burst, very much in the manner of popcorn exposed to flame. The growth will continue during steaming-out operation, and will probably render the exchanger a total loss.

Safety Measures

An overall plant inspection department has been set up to assure continuous operation, and to guarantee as far as humanly possible, the safety of pressure vessels and all equipment. These inspection engineers are called in to advise upon the design of new equipment, and to act as inspectors during fabrication either at the plant shops or when vessel manufacture is contracted. By this procedure, they are assured of the suitability of equipment for the designed service. They also become familiar with the equipment before it arrives on the job. Permanent records are retained on material thicknesses and any other unusual features. The plant inspectors requisition all safety valves used in the plant, and test and maintain these vital pieces of equipment at all times. The group are used as consultants for the use of ferrous and non-ferrous materials, as well as the procedure of welding technique used on original fabrication and repairs, necessary from time to time.

Safety of plant personnel in all phases of the industry is directed by a committee maintained at all times under the direction of the safety department. This committee discusses specific hazards and analyses protective measures which should be, or have been, incorporated throughout the plant. Some of the inherent hazards require a great deal of careful thought by the operating and engineering departments. prior to design and installation. One of the major problems is to provide adequate ventilation in the buildings which house the large gas compressors. The hydrocarbon gases are heavier than air. For this reason fresh air supplies are taken from high points on structures to avoid the possibility of gas accumulation near the ground.

Experience has shown that it is not feasible to exhaust these gases at floor level. This is because the heat from compressor engines creates a natural circulation to the top of the building. Both from a standpoint of personal comfort, and also an adequate purging of the gases which may be present in the building, it has been found desirable to exhaust from the roof. The fresh air which is forced into the building is admitted to the room at floor level or used to purge the trenches installed for process piping.

Fire protection is the responsibility of the fire marshal, and a small force of permanent firemen. The water for fire fighting purposes is supplied from special pumps in the main pumphouse through ring main fire systems. These are designed to feed into any specific location from two or three points. In addition, adequate chemical storage is provided for the foam systems used as blanketing for certain types of fires. The capacity of the system is sufficient to provide

3500 gal. of water per minute to each of two isolated fires in the plant at the same time.

When, as, and if a fire occurs in one of the processing units, it is highly desirable to reduce the pressure in the equipment and remove the liquid hydrocarbons contained in the vessels or drums. In order to do this there are numerous problems confronting the engineer. A portion of the gaseous stream is not condensible, except in the very heavy equipment. If it were used it would be necessary to provide pumps to remove the material from the unit to a place of safe storage. On the other hand, if the pressure is suddenly reduced, the rapid expansion causes a very large temperature drop and consequent freezing. All these factors have to be taken into consideration in the design of equipment which will give even reasonable protection during emergency period.

A few of the problems confronting the engineer have been briefly referred to in the foregoing short description. Space will not permit any discussion on the multitudinous instrumentation and control problems, but their magnitude can be visualized by realizing that the instrument department has a personnel of 47, and that the installed value of instruments in the plant amounts to well over a million dollars.

Research and Plant Control

In the popular book " This Chemical Age ", written by William Haynes, and published in 1942, the author titled his chapter on petroleum refining as " Chemists in Spite of Themselves ". The laboratory at Polymer fully bears out the caption. The personnel amounts to approximately 160, of which some 40 members are university graduates, and a rather large portion of these have Ph.D. degrees. Some of the work consists of current plant control problems, the analysis of feed stock streams for accounting control, and the evaluation of rubber products, both in the crude state and compounded by standard methods used in the rubber industry. In order to accomplish the vast amount of work undertaken, podbielniak distillation columns, spectroscopes, and even the mass spectrameter are in constant use.

The synthetic rubber industry has only been in existence for three years. It is probable that changes in manufacturing technique, the type of hydrocarbon monomers used, and the technique of rubber compounding will advantageously affect the quality of the finished product. For this reason a comprehensive research programme has been actively commenced, headed by the present Polymer personnel and coordinated with research work at universities, the rubber companies, and the National Research Council. Early this year, a pilot plant was completed for the preparation of styrene-like monomers and copolymerization of Buna-S type rubbers. Already valuable information is being obtained. It is the intention to actively promote research on all types of synthetic rubber, as both the company at Sarnia and the Canadian government are convinced of the advantages that this industry will provide in Canada.

Polymer Will Stabilize Rubber Prices

The future of the synthetic rubber industry is essentially one of economics, although United States rubber companies recommend government protection for a reasonable amount of synthetic production during reconversion. All parties are convinced that the economic value of maintaining synthetic production is well worth while if only to act as a stabilizer on the price of all rubber used. A glance at the cost of rubber during the past 40 years emphasizes the concern of rubber manufacturers in maintaining synthetic production on this continent. Sarnia management has been very active in trying to maintain full production rates. A considerable portion of Sarnia production has already been exported to Scandinavian countries, Great Britain and South America.

In addition it is recognized that some of the by-products from operations can be profitably sold, and contracts have already been made with Dow Chemical Co. at Sarnia, and with Monsanto Chemical Co. at Montreal, for the sale of 12 million lbs. styrene per year. This is the excess capacity of the present styrene plant at Sarnia. The Dow Company is now building a new plant at Sarnia for the manufacture of ethylene glycol, which will utilize ethylene production in excess of that required for synthetic manufacture. This plant is large and will require utilities which are available at the steam and power plant. Arrangements have already been made to serve this large neighbouring industry.

The new industry is paying its way. All indications point to a bright future, and it is confidently expected that Canada's Polymer Corporation will remain to serve the community at Sarnia, and the Canadian people at large, for a long time to come.

DIAMOND JUBILEE MEETING

of the Institute

ROYAL YORK HOTEL, TORONTO

May 8th, 9th and 10th

THE PRINCIPLES OF PRESTRESSED CONCRETE

PROFESSOR G. MAGNEL
University of Ghent, Belgium

This paper is a resume of several addresses given by the author before various Branches of The Engineering Institute of Canada in May 1946, and has been prepared for the Journal by special request. Prestressing is explained in a way that any member of the profession could understand. Three methods of prestressing are given and each explained in detail. The economies obtainable by the use of prestressing make this short and very clear explanation a subject of prime interest and importance to today's and tomorrow's engineers.

The idea of prestressing is so simple and logical that it has been applied daily for ages in a great number of human activities.

In making a wooden wheel, when the workman places the external steel hoop around it, properly heated, so as to put the wheel under compression after the temperature has returned to normal; that is prestressing. If the hoop were heated electrically, Mr. Billner would speak of it in modern terms as " electrical prestressing ".

When we want to remove a series of books standing in line on the shelf of a library, we are careful about two main things; not to take too many books at a time, and to press them as hard as necessary between our hands; this again is prestressing. Together the books resemble the shape of a prismatic beam, but the material of which that beam is made has no tensile strength, so that it cannot resist the bending due to the dead load of the books between our hands which act as end supports. But if with our hands we put the whole beam under a longitudinal compression, it acquires a tensile resistance, since it will be able to resist any bending moment giving tensile stresses smaller than the compressive stresses set up by the action of our hands.

The theory of prestressing being so simple, it is quite natural that, as soon as reinforced concrete was developed, the idea should have been applied to it. This actually did happen, although the first steps in that direction were far from successful.

In reinforced concrete there are more reasons than anywhere else for applying the idea of prestressing, because;

1.—Concrete has a very poor tensile strength, and a poor capacity for elongation before it breaks under tension. The result is that in a concrete beam, carrying its working load, the concrete submitted to tension is incapable of following the deformations of the tensile steel reinforcement to which it is united by bond; moreover in all beams under working load, the concrete is haircracked, which increases the deflections of the structures.

2.—The low tensile strength of concrete is accompanied by poor resistance of beams against shear; this compels the engineer to give great thickness to the webs of the beams he is designing, and makes long spans impossible in reinforced concrete, because the dead weight becomes too great.

3.—Concrete is subject to cracking as a result of shrinking, and these cracks are frequently wider than hair cracks.

The reader can no doubt understand that these three evils would be avoided if we could put the concrete under uniform compression, possibly in all directions, before the unavoidable forces of dead and live load and the effects of shrinkage act upon it. This means prestressing the concrete, or arranging things so that, if dead and live load together with shrinkage give a tensile stress on a certain surface around a certain point, this surface will be subject to a pre-established compressive stress higher than the tensile stress referred to. The resultant stress will then be compression, and cracking will be out of question.

How are we to apply this in practice on concrete structures? There are three different ways of doing so known to us at present. Let us enumerate them and analyze each one.

A.—Consider a bridge of 66 ft. span, capable of carrying a live load of 420 lb. per sq. ft. The quality of the concrete allows a safety stress of 1500 lb. per sq. in. The bridge is supposed to be a simple slab. Let us make a slab 2 ft. 8 in. thick, containing in each strip of one foot width and close to the lower fibres at mid-span, two rods capable of being stretched each up to about 75 tons. These rods are placed in a sheet steel tube to prevent a bond between them and the concrete. They are somewhat longer than the slab, so that their free ends can be seen outside the slab at both ends of the span.

As soon as the concrete has sufficient strength, we will prestress it by putting the reinforcing rods under tension, this tension being transmitted as a compression to the concrete. This can be done by special anchorages fixing the rods at both ends against the concrete. In reality, one anchorage is fixed against the concrete before the rod is stretched, then the tensile load is applied to the rod on its other end, and while the rod is under tension the second anchorage is applied to it so that when the jack loosens its grip on the rod, this rod cannot resume its initial length again. This puts the concrete under compression between the anchorages fixed to its two ends.

For the past fifty years many inventors have tried to apply the above method. The first to be successful was the French engineer Freyssinet. All his predecessors used rods in mild or semi-mild steel. They got some results immediately after the first prestressing, but the greater part of the prestress had disappeared after one or two years.

The reason for this lack of success is obvious, but it took the engineering world some thirty years to grasp it. It reflects great credit on Mr.

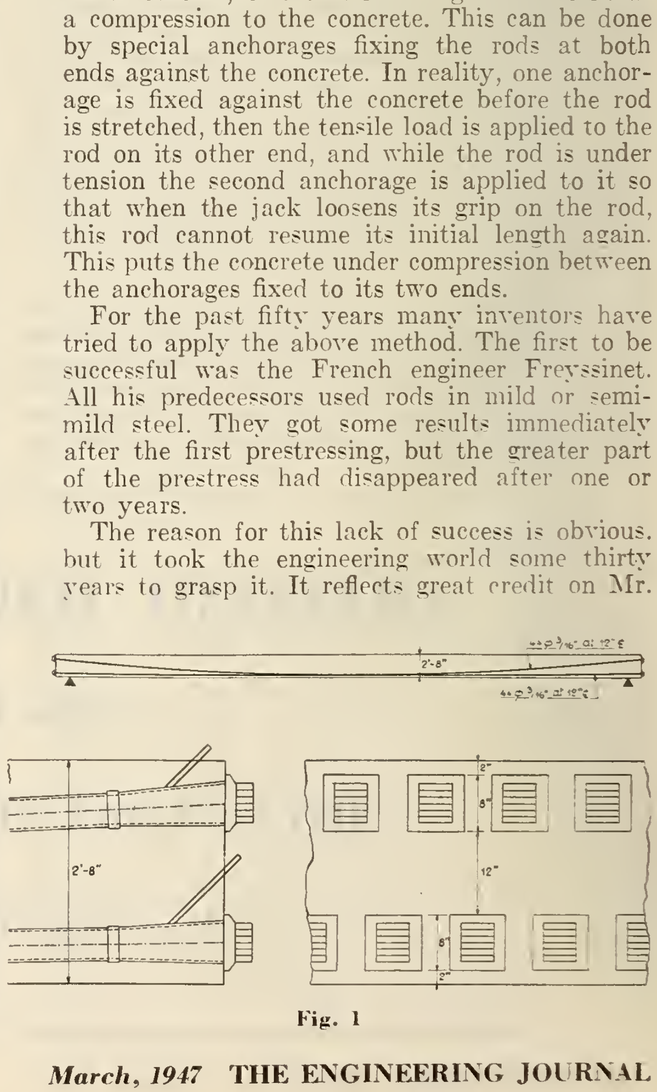


Fig. 1

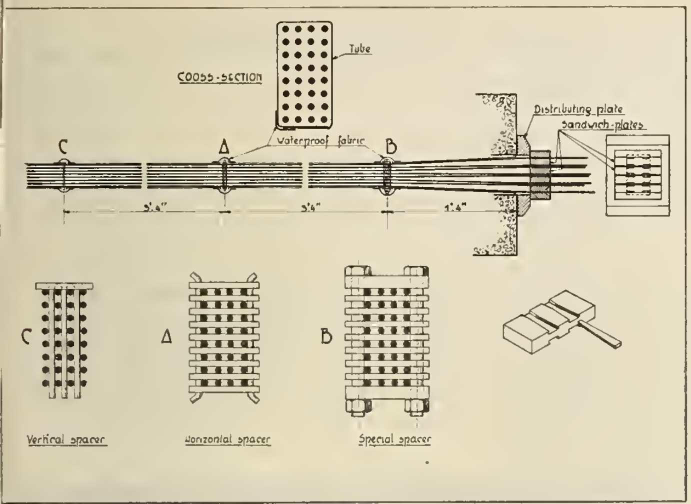


Fig. 2

Freyssinet that he called attention to it. With mild steel stressed up to 16,000 lb. per sq. in., the elongation in our 66 ft. bridge span is roughly half an inch. But if we consider the shrinkage and creep of concrete, we soon realize that with the concrete decreasing in length in the direction of the span by one quarter of an inch, due to the creep and due also to shrinkage, nothing will be left of the prestress after the first few months. In other words, with mild steel rods we cannot establish a permanent prestress. The half inch elongation of the rods disappears gradually, and the grip on the concrete is loosened.

But, if we could use a grade of steel which permitted working stress of, not 16,000, but 120,000 lb. per sq. in., the elongation would be about four inches, whereas the reduction in length of the concrete through shrinkage and creep would remain at its original value of about one half an inch. This means that here the loss of prestress would be limited to about 12½ per cent, so that it would be sufficient to increase the theoretical quantity of steel by the same amount, if ultimately we wish the prestress to remain sufficiently high.

Now, steel that can carry a safe stress of 120,000 lb. per sq. in., is available in the form of cold drawn steel wire up to 3/16 in. in all countries, while in Belgium it can be procured in sizes up to 5/16 in. We will then replace each rod, each with a tensile strength of 75 tons, by a cable containing 44 wires of 3/16 in., to which we will apply a stress of 120,000 lb. per sq. in.

Fig. 3—Prestressing apparatus.

In Fig. 1 is given a schematic view of the bridge; Fig. 2 gives the details of the anchorage at the ends of the cables, and of the cables themselves; Fig. 3 is a photograph of the light prestressing apparatus which prestresses two wires at a time, wires which are fixed after prestressing with a common wedge in one of the four grooves of what we call the "sandwich plates".

As seen on Fig. 2, the wires are placed in a sheet steel tube. When all the prestressing work is finished we inject cement grout in the tube, so as to protect the wires against rust and to get the benefit of the bond between the wires and the concrete. This bond, although not required for normal safety purposes, is an additional safety measure. This is shown by the following experiment made in our laboratory.

A normally prestressed beam is such that the first cracks occur at mid-span for a point load of 36 tons; its ultimate load, which causes breaking of the wires, is 60 tons; the safety load is 26 tons. We have tested a similar beam after cutting the anchorages away so that we could rely only on the bond. This beam behaved exactly as a

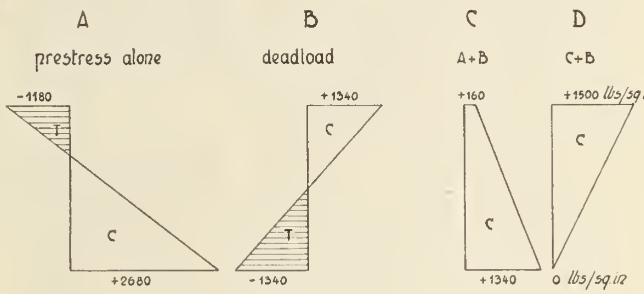


Fig. 4

normal one up to a 27 ton load, then the slipping of the wires commenced in the concrete. This shows that the anchorages at the ends of the cables do practically nothing, as long as the working load is not exceeded.

In Fig. 4 are reproduced the stress diagrams in the section at mid span of this slab. Here the dead load is exactly equal to the live load.

A is the diagram due to prestressing alone.

B is the diagram due to the dead load if the concrete were capable of resisting a high tensile stress up to 1340 lb. per sq. in.

C is the diagram under prestress plus dead load. Here it should be noted that these forces always exist together.

D is the diagram when we add to C the live load (equivalent to B). In other words it is the diagram when the bridge is fully loaded.

It should also be noted that whereas in an ordinary reinforced concrete slab or beam, the shear develops diagonal tension which is equal to the shear stress; in a prestressed beam the shear stress is similar but is no longer equal to the maximum tensile stress; this can be easily shown by the use of the circle of Mohr. For example, in the bridge under consideration, the shearing stress is 95 lb. per sq. in., but the principal tensile stress is only 13 lb. per sq. in.

Finally the reader will understand that it is impossible to use straight prestressing cables in a slab similar to the one considered above. The

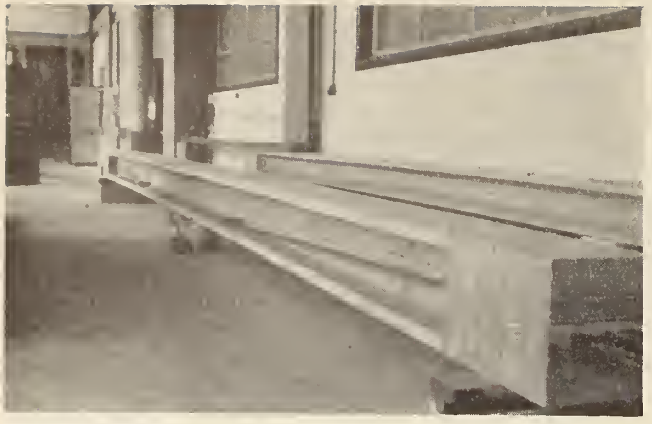


Fig. 5—Prestressed concrete beam cast in the University of Ghent laboratory.

cable must be placed so that it is close to the lower fibres of the slab at mid span. But if it were kept so low close to the end supports, the concrete would crack under tension at the top of the slab. The cable must therefore be lifted up towards the supports and have a parabolic shape, as shown on Fig. 1. A special characteristic of a prestressed bridge is that the stress in the steel varies only by 3 or 4 per cent when the live load is applied. Thus ends a somewhat lengthy description of a bridge made in accordance with the first system of prestressing.

B.—A second method is to place the cables outside the concrete. Let us assume we have a beam with an I-shaped cross section. We can then place the prestressing cables on each side of the web and let them pass through special end blocks, against which we will apply the anchorages. The change in the direction of the cables can be made around

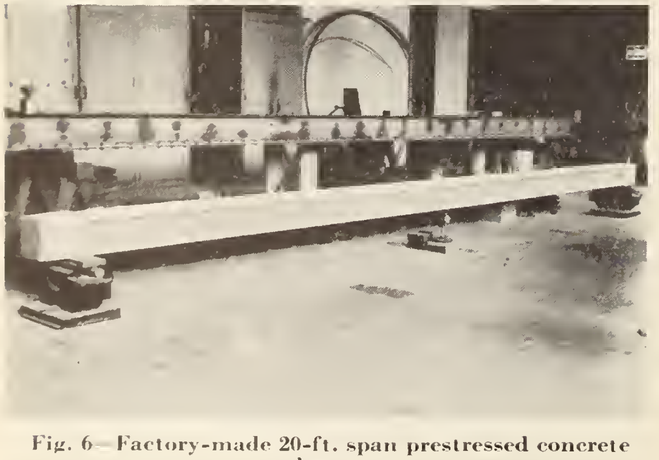


Fig. 6—Factory-made 20-ft. span prestressed concrete beam.

short ends of steel rods placed through the web at convenient places. Such beams can be made in precast unit blocks put together either with mortar in the joints, or without any bonding if their geometrical shape is sufficiently accurate. Figure 5 is a photo of such a beam built in our laboratory. Many such beams have been erected in Belgium.

C.—Finally there is a quite different way of making prestressed beams, where no anchorages are used at the ends of the cables, but where the bond between concrete and steel takes the place of such anchorages. It is presumed that the wires used are very thin so as to increase the surface capable of giving bond. Maximum diameters of 5/64 in. (or 2 mm.) are used.

The method of building the beams is as follows; the wires are stretched up to 200,000 lb. per sq. in. between end abutments, or by carrying the reaction on the steel mould of the beam, which in such case must be very strong. The concrete is then poured in and vibrated. Once the concrete has sufficiently hardened, the wires are cut off. They have a tendency to resume their initial length but the bond prevents them from doing this, so that the concrete is placed under compression.

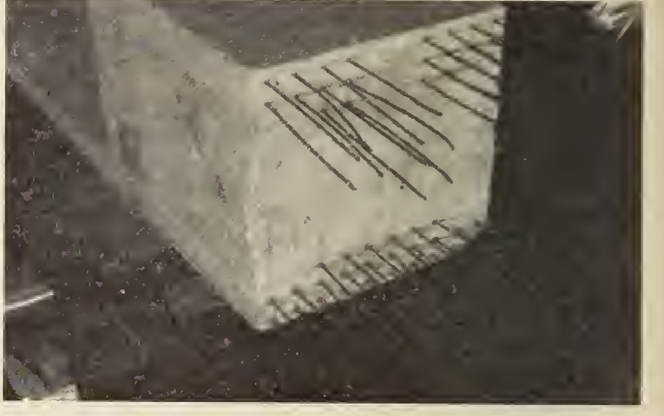


Fig. 7—End of prestressed concrete beam showing piano wires used for prestressing.

In a small beam of 20 ft. span, it is necessary to place as many as 40 piano wires of 5/64 in. diameter. It is at once seen that such beams can only be made in a factory. This limits them to a size that can be transported to the job. Figure 6 gives a view of such a beam. Figure 7 shows one end of it where the wires may be seen coming out of the concrete.

Conclusion

Prestressing is so logical that it is bound to be the solution of the future. Its actual development is such that it is practical and at the same time economical. Consider that the bridge referred to under "A", with its thickness of 2 ft. 8 in., must have a thickness of 3 ft. 7 in. if we make it in reinforced concrete, even when using the high safety stress in the concrete of 1500 lb. per sq. in. Consider also that the quantity of steel required in prestressed work is only one fourth to one fifth of what is required in ordinary reinforced concrete.

Consider finally that in ordinary reinforced concrete we cannot use the high qualities of modern concrete, as this would mean making beams of such little depth that the amount of steel reinforcing required is prohibitive. In the bridge referred to above, with a concrete stress of 1500 lb. per sq. in., we find a percentage of steel in the 3 ft. 7 in. slab as high as 2.4, which is unreasonable, so it is obvious that the 3 ft. 7 in. thickness is too small for ordinary reinforced concrete work, whereas we can make the slab satisfactorily in 2 ft. 8 in. thickness in prestressed work.

There is no doubt that prestressing has a great future. A few years from now there will be no more bridges built in concrete, except on prestressed lines.

LARGE-SCALE HOUSING—ITS PLANNING AND CONSTRUCTION

JOHN P. RILEY
Director of Development, New York City Housing Authority

An address delivered before the Montreal branch of The Engineering Institute of Canada, on November 28th, 1946.

Mr. Riley is one of the foremost authorities on large-scale housing. Two hundred million dollars worth of housing construction is a normal year's undertaking for him. In this interesting and timely article, he tells of the New York City housing authority's prewar success in cutting costs per apartment by improvement in design, by standardization, by elimination of non-essentials, by use of controlled concrete, and by securing co-operation between owner and contractor.

Potential savings in various building components are analyzed, and possible unit savings in walls, floors and roofs are translated into savings per apartment.

The Authority's difficulty in forecasting building costs, and its experience in securing acceptable bids in a rising postwar market are described. Current trends in construction costs are discussed.

The problems and solutions dealt with in this address are those pertaining to large public housing projects. Large-scale housing, as we know it today, is a development of the past decade. It is here to stay, whether publicly or privately financed, and the problems of design and construction are similar to either one, no matter who does the financing.

To help visualize the scale of the New York City Housing Authority's operations, it should first be explained that the fourteen housing projects now operated, house 17,000 families, or 57,000 persons. All the population of Three Rivers could be put into them, leaving quite a lot of room for visiting relatives. They cost about $90,000,000 for land and buildings, and range in size from 100 families to 3,500 families, with an average size of 1,200 families.

The post-war programme which the Authority already has started will add sixteen more projects, holding 20,800 families, or 80,000 persons. They range in size from 600 families to 1,900 families, with an average size of 1,300 families. The cost for land and buildings will be at least $225,000,000 and probably more. Add them to what is already built and they could accommodate nearly all the city of Quebec, or the city of Ottawa. This programme has already been started. All of the sites are owned by the Authority. Plans are completed for eleven of them. Buildings have been demolished and the Authority is now building on seven sites, and is asking for construction bids on four others. In addition, preliminary plans are to be started for six more projects to house 7,500 families, in the hope that financing will be available next year.

It is not intended to discuss temporary or emergency housing, except to say that provision is being made for such dwellings for 10,000 families by every possible means; Quonset huts, re-assembled barracks and temporary houses, and emergency conversions of vacant tenements. In addition to this, there is the programme of the Metropolitan Life Insurance Company, already under way, as well as the projects contemplated by other insurance companies, and by the various savings banks under recently enacted legislation by the State of New York. Thus it can be seen without going outside the boundaries of New York City that large-scale housing is no longer an experiment.

No audience cares to listen to a lot of dry statistics, not even an audience of engineers. Yet a few must be quoted so that the scale of operations involved can be visualized, and some of the otherwise inconspicuous but very effective ways of achieving economy can be realized. Economy is stressed, not cheapness, and every engineer will know what is meant. There is no economy in the use of poor methods or materials. It is necessary to determine in advance, and from actual experience both in construction and operation, the most economical standard for each element of construction; and then to see to it that not one iota more than this standard creeps into the design, and that not one iota less than this standard is permitted in the construction, using the very best materials and equipment obtainable.

It may be helpful to quote a little history at this point, to show how this works out in practice. The first three public housing projects in New York City were First Houses, Williamsburg, and Harlem River Houses. They were built, and are still owned, by the Federal government. The Authority operates them on a lease basis. Their total population is 2,300 families, and the cost of construction alone, was $5,400 per apartment. In 1938, the New York City Housing Authority started building on its own. Since then, and until the war halted building operations, eleven projects were built, housing about 15,000 families. The average cost for construction alone was $3,300 per apartment, though they have been built for under $3,000. These projects are just as well built as, and possibly better than, the first three.

What made it possible to cut construction costs almost overnight to 60 per cent of what they were before? It was done by a very realistic and direct approach. Instead of specifications such as would be written for monumental buildings, standards of design and construction based on good commercial practice were formulated. Inspection, while thorough and efficient, was carried out for the good of the job, rather than through rigid and blind observance of the specifications. All non-essentials were stripped from the design. Prospective bidders were taken into the confidence of the owner, so to speak, by open meetings to discuss plans and specifications *before* bidding, and to prevent errors and misunderstanding.

It is most interesting to see what results are attained by a deliberate effort to promote good understanding between owner and contractor. The practice adopted of pre-qualifying bidders on major contracts made it safe before the war, when the construction market was stable, to eliminate the usual surety bonds, with a consequent saving of several hundred thousand dollars. The practice of open discussions, continued past the bidding stage and throughout construction, has paid dividends, too. Because of these factors, plus the most thorough design and inspection, the Authority's record for cost of extra work has totalled less than one-half

Kingsborough Houses. The cost here was less than $3,000 per apartment for construction. The development of Z-type units is shown. Buildings occupy only 18 per cent of the site.

are familiar with the closet at the incinerator where refuse is disposed of. The Authority developed its own type of incinerator hopper door, with a fire-resistive rating equivalent to the enclosure previously used. This not only saves the cost of the usual closet, or enclosure, but by its elimination permits more compact design of the buildings. Doors are left off all the closets, except one, in each apartment. A closet need not even be within the bedroom if it can be more compactly located just outside the door. This is not necessarily recommended for higher-rental apartments, but the intention was to eliminate non-essentials, and this saved at least $60 per apartment, even at pre-war prices. Nothing but oversize brick is now used. Corners are cut so fine that even the metal door bucks come to the job with the metal saddle already welded to the buck to save separate installation at the job. These few points are cited to outline the technique.

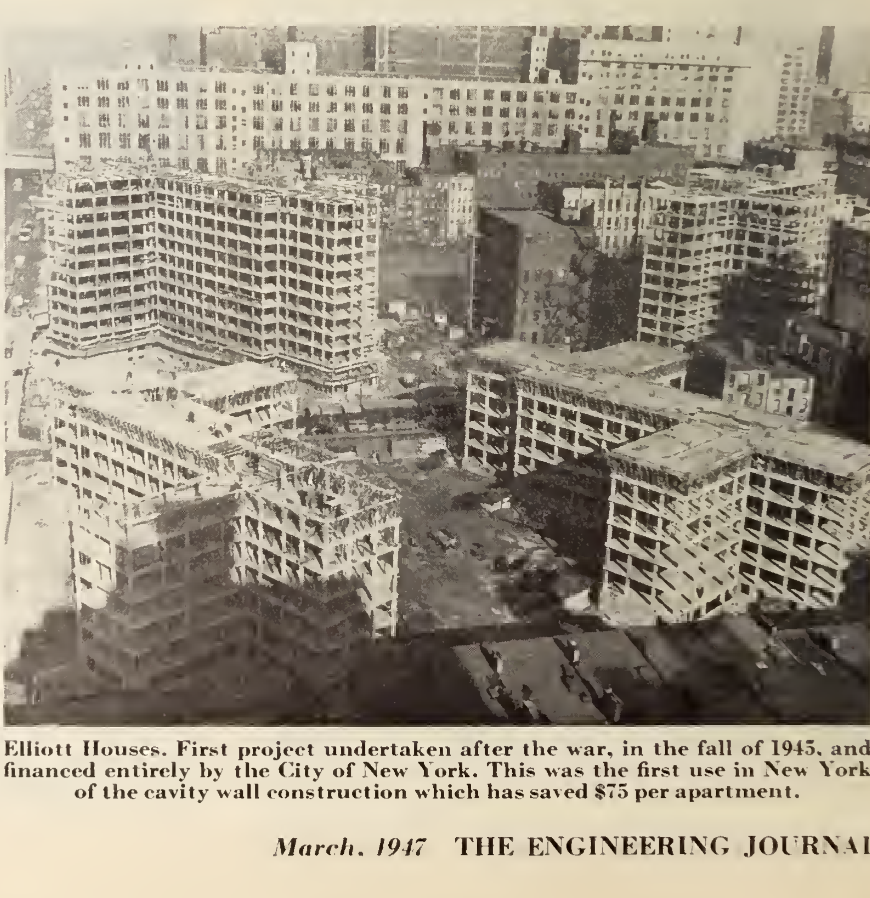
of one per cent on all their jobs; a figure which is believed to be unusually low for construction work of any kind.

The Authority was, so far as is known, one of the first organizations to use controlled concrete on a large scale. By controlled concrete is meant the preparation of design mixes before a job starts, using the very same cement and aggregates which will be used on the job, and ascertaining accurately in advance just what will give the most economical results for the design strength used. It is so efficient and so important, that a staff of trained concrete engineers is maintained just for this one phase of construction operations. It is so economical that it is even used for cellar floors, ramps, etc., where strength is not even a factor, and where plain concrete is normally considered cheaper. It brings double-barrelled economy, both in saving in cement and in the saving in space because of reduced size of members.

This is emphasized because it is estimated that about $100 is saved per apartment, and when apartments are built by the thousands, that saving mounts up. There are no plastered ceilings. The emphasis on "quality" concreting makes it possible to get a perfectly presentable ceiling by painting the under side of the concrete floor slab. This saves another $100 per apartment, exclusive of the saving in height of buildings by using this method of construction.

Those who live in apartments

These large housing projects are very complex. In the first place, the existing New York city ordinances, such as the building code and the multiple dwelling law, under which the Authority must operate, never contemplated these large multi-block developments. In the second place, the very act of taking several city blocks out of the heart of a busy city, closing the streets and revamping the whole area, is a major undertaking by itself. For example, in the case of the Fort Greene houses there were 26 city blocks involved.



Elliott Houses. First project undertaken after the war, in the fall of 1945, and financed entirely by the City of New York. This was the first use in New York of the cavity wall construction which has saved $75 per apartment.

It takes months alone just to work out the re-arrangement of all the public and private utility lines which run beneath and above the surface. All these studies and negotiations have to be carried on simultaneously with the design of the project itself, so that a start has to be made at least a year ahead.

East River Houses. Notice the open parapets in place of solid masonry. This project showed a record low construction cost of $2,980 per apartment, for modern fireproof construction with all conveniences. Eighty per cent of the site is open space.

The New York City Housing Authority was the first to show that fireproof housing, in large-scale operations, need cost no more than non-fireproof and can even be built at less cost. The Authority showed that it is more economical to build six-storey elevator type buildings than the three- and four-storey walk-up type previously considered the least expensive. Other things were learned as well. A start was made with wall-bearing construction, on the premise that it was more economical. After the first two jobs, a switch was made to skeleton-frame construction as an experiment. It has been found just as economical, just as fast, and conducive to much cleaner construction operations. Over and above these factors, the war has since shown the greater safety of this type of structure in disaster.

As the programme progressed, construction began to reach further into the heart of the slums. With land costs increasing and with soil conditions requiring costly piling operations, it became apparent that perhaps six storeys were not enough to realize full economy. When one considers that on some of the projects the cost of piling alone is $1,500,000 it can be understood why there was so much at stake. But apparently there is some theory that the higher the building, the more undesirable the social effect. With some trepidation, therefore, and with social workers all over the country watching, the Authority went to ten and eleven storeys. It worked perfectly. On the next job, 13-storeys were tried and, on some of the jobs yet to be started, heights up to 14-storeys will be undertaken. Since building frames are predominantly concrete, it is interesting to note that this present economic height of 14-storeys is based on the working limit at which concrete can be efficiently placed by crane and bucket. The hoist and runway method disappeared from our operations years ago.

Aerial view of East River Houses. The Authority's first project featuring more than six storeys. It represents an excellent treatment of bulk. Note the long central mall with eleven-storey building at one end.

Bids are being opened on December 10, on a $14,000,000 construction contract which will be bid both in concrete and steel, with a complete set of plans for each. All buildings in this project are 14-storey and it is desired to find out just where a height limit is reached where steel may be more economical than concrete. At the same time, the design of a 1,900 family project is being started where all 16-storey buildings will be used, in order to reduce the number of buildings so that interference with important underground utilities can be avoided. The Authority is seeking to determine whether to make these buildings steel or concrete. With cost factors as erratic as they now are this requires a very careful analysis.

No one type of housing unit can

be said to be the most desirable for all use. The particular problem at each site, coupled with the types of buildings used, dictate different requirements. In each instance, however, the emphasis is on how space is used. The secret of economical housing construction is the efficiency,—one might even say the frugality, with which space is planned. This cannot be over-emphasized. More time is spent studying plans for this than for any other aspect. If that central core of the building can be made as compact as possible, you are over the first hurdle.

The minuteness with which one must approach large-scale operations, in order to reap the fullest benefits, is best exemplified by analyzing those parts of the building which involve *areas* primarily. For example, the exterior walls represent 17 per cent of the cost of the building; the floors represent 20 per cent; the roof represents four per cent, and the interior partitions represent eight per cent. These four parts total 49 per cent, so that half the cost of the building is in these area factors alone, as distinguished from plumbing, or heating, or doors or elevators, etc. To show vividly what this means, two-inch solid plaster partitions are used. If those partitions were 2¼ in., even though the partitions themselves cost no more, the cost of the increased area of floors, walls and roof, because of this additional ¼ in., would be the equivalent of 12 cents per square yard of partition, and it would bring no advantages. For a 2½ in. partition, the penalty would be 24 cents per square yard. For a 3 in. partition it would be 48 cents. If you think these are small figures, just consider that for the average project they amount to $20,000, $40,000 and $80,000 respectively.

On the exterior walls, for every cent saved in the cost per square foot of exterior walls, the saving per apartment is $4.50. For every cent saved in the cost per square foot of floors, the saving per apartment is $8.00. For every cent saved in the cost per square foot of roof, the saving is about $1.00 per apartment. Much trouble is even taken to get the concrete columns down to 11½ in. square instead of 12 in. because you can form an 11½ in. column with one 4-foot width of plywood, but you can't form the 12 in. column. All this shows you what that cent is really worth. The point of all this is that it is not necessary to make spectacular changes in design to save money. There is just as much gold to be extracted by concentrating on the factors just listed, even though when you are done, the building may look practically the same and the quality will not be impaired. The pay-off is in the aggregate money saved.

It has been asked whether major changes in methods and materials of construction are expected to evolve from war discoveries. In 1943, the Authority took a major gamble. We wanted to be ready to build housing at the earliest possible time after the war. The Authority had to decide whether we should prepare only preliminary plans, so as to be ready to adapt ourselves to changes arising from the war, or to go the whole way and prepare complete plans and specifications for over $150,000,000 worth of work. The latter was recommended by the author, even to the extent of using the then standard specifications. These, by the way, still fit practically 90 per cent of our work on any of our jobs. This, the Authority decided to do, and the answer is that we are right now building and bidding projects with practically no deviations from the path we plotted in 1943.

Fortunately we guessed right and are ready. It is disappointing, however, that so little wheat can be sifted from the chaff of the glowing predictions of high-pressure salesmen, about the changes we would see immediately after the war. For example, why hasn't someone evolved a plastic floor covering? There are 230 acres of floors to build. Why hasn't someone brought out an economical pre-fabricated partition to eliminate the time lost by the present archaic method of plastering? There are many new types of partitions, but, so far, none is less costly than our 2 in. plaster partition. Why hasn't someone improved on the present method of exterior wall construction? Here again, study has been given to every new type of wall construction in the hope that someone, sometime, would come in with the answer. The cavity wall construction at Elliott Houses is an example of what can be done in this respect. This wall construction has been the subject of an excellent report by the British Building Research Station. The Authority was the first concern in New York city to use this type of wall construction. Its use has saved nearly $75.00 per apartment.

As to pre-fabrication, there has been a great deal of misunderstanding about this term as applied to large-scale housing, primarily because it has been associated popularly with the delivery to a site of a completely fabricated dwelling unit. In the true sense of the word, there should be a constantly increasing field for pre-fabrication in work such as ours. For example, in the case of partition construction, certain plumbing and kitchen assemblies could be pre-fabricated. We already pre-fabricate the door frame and saddle, in effect.

There is another inconsistency which has puzzled everyone whose duty it has been to administer building ordinances. A fireproof building embodies all precautions against combustion, both in materials and in the forms of construction used. A non-fireproof structure does not and should, in principle, therefore require more safeguards. Fundamentally, the enclosure walls of the fireproof building are there to provide adequate insulation and protection against the elements. Yet, in New York City, and in many other cities exterior walls of the fireproof building must have a higher fire-resistive rating than those of the non-fireproof building. How can improvements in wall construction develop with inconsistencies and penalties like these?

Construction Costs

Now, a word about construction costs in this year of 1946. Prior to the war, we were building fireproof buildings for less than 40 cents per cubic foot. It had been a hard fight to accomplish that low cost, and an attempt has been made to show you how the Authority went at it.

During the war years, when we were planning the projects which we are now building, the hardest problem was to estimate costs of projects for which we were then making financial contracts, but for which no one could forecast when they would be built or under what cost factors. The author is not an economist. Yet, by a combination of crystal ball, ouija-board and instinct, we set the probable post-war costs at about one-third more than 1940, the last normal year. When we were ready to resume building a year ago, we were rather proud when all the so-called construction economists stated that current costs then were about 35 per cent above 1940 —almost exactly what had been guessed two years before. (*Continued on page 135*)

CERTAIN ASPECTS OF FREQUENCY MODULATION AND TELEVISION BROADCASTING IN CANADA

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A summary of addresses given on November 14th, 1946, before a joint meeting of the Montreal branches of The Engineering Institute of Canada and the Institute of Radio Engineers, and on February 4th, 1947, before a joint meeting of the Toronto branches of The Engineering Institute of Canada, the Institute of Radio Engineers, and the American Institute of Electrical Engineers.

This is an article of exceptional interest to Canadian radio and communication engineers. The author's comparison between AM and FM broadcasting is a clear explanation of what may be expected from frequency modulation. The presentation of the problems involved in television is timely and deserves serious consideration by the profession. The industry is aware that much educational work must be done in advising engineers, and the public, as to what they may expect in these fields and as to the pitfalls if good engineering principles are not employed.

Recently there have been two very important developments in radio: the rapid growth of frequency modulation in sound broadcasting, and the introduction of television in the United States as a regular public service. Before the war, both these developments had already made a good start when more vital problems forced them to the background for the duration. Now, with the restoration of peace-time conditions, both frequency modulation and television, revitalized by extremely important wartime developments in allied fields, are emerging from their forced retirement with greater impetus than ever before. In the United States, which seems to be leading the world at this time in technical broadcasting development, the introduction of these new services is taking place under very controversial conditions, reminiscent of the historic technical battles of bygone years. Evidently, because of their natural scepticism or, as some uncharitable souls might even suggest, because of the influence of the vested interests which employ them, engineers do not seem able to bring forth any significant technological development, without indulging at the same time in some more or less playful scrapping.

In 1860, it was "AC vs. DC", the "Battle of the Currents" they called it then, with Thomas Edison and George Westinghouse leading the factions. And now, after many other similar historical controversies, the engineers and their employers are at it again; today, in sound broadcasting, it is FM vs. AM; in vision broadcasting, even before the new industry has had a chance to make a start, it is colour vs. black and white.

Of course, there is nothing like a good argument to bring out the facts, and for Canada these controversies have much more than academic interest. Not only is our own technical economy bound to be influenced greatly by developments in the United States, but the similarity of our problems often demands similar solutions. It may, therefore, be of interest at this time to examine more closely these two issues, starting first with the question of FM and AM.

Comparison of AM and FM

The terms AM and FM are simply abbreviations for Amplitude Modulation and Frequency Modulation, respectively. Speaking generally, electro-magnetic waves are characterized by their amplitude and their frequency; and transmission of intelligence by radio is accomplished by changing either or both of these variables. Figure 1 illustrates the difference between AM and FM. Without modulation, both AM and FM carriers are the same, and the difference between the two systems appears only with modulation. In this illustration the intelligence to be transmitted, or in other words, the modulation, is taken to be a sine wave or pure tone.

In amplitude modulation, the system which was used exclusively until now, the frequency of the transmitted wave remains constant, while its amplitude is made to vary up and down with the rhythm and volume of the sound, voice or music to be transmitted. In contrast, in frequency modulation the amplitude remains constant, while the frequency is made to vary back and forth in accordance with the character of the intelligence to be conveyed. In AM, the degree of modulation is expressed in per cent, where 100 per cent corresponds to the unalterable limit of distortionless modulation when the amplitude of the carrier varies between zero and twice its unmodulated value. Deeper modulation than this results in distortion.

In FM, on the other hand, the point at which distortion is reached depends on the design of the system. Thus, there can be systems with swings of plus or minus 15, 30, 75 kilocycles; or more or less if desired. This change in frequency of the carrier from its mean position is called "deviation". Obviously, there are practical limits to usable deviations, but these come from considerations of economy in spectrum utilization rather than from circuit limitations.

This is the only fundamental difference between AM and FM, but in practice, when considering the

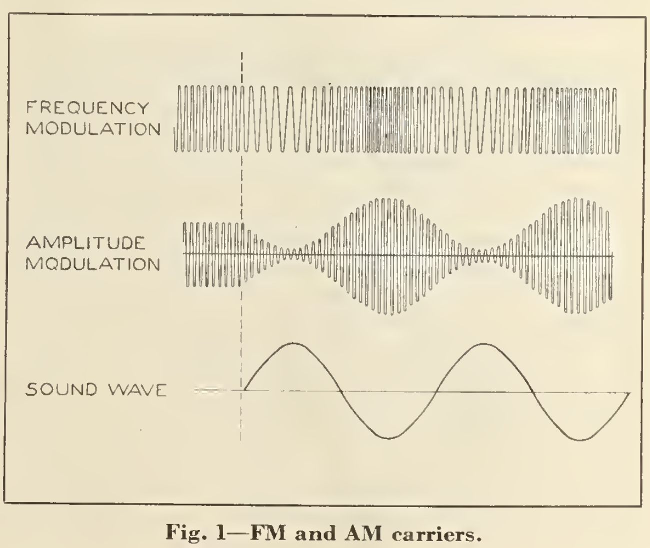

Fig. 1—FM and AM carriers.

application of the two types of modulation to broadcasting, there is an incidental difference which is also of paramount importance. Standard AM broadcasting operates on medium frequencies between roughly 0.5 and 1.5 megacycles. On the other hand, FM broadcasting uses much higher frequencies, in the neighbourhood of 100 megacycles. In comparing AM and FM broadcasting it must, therefore, be kept in mind that there are two important differences; the difference in modulation and the difference in frequency.

However, before going too far with any new system, it might be well to find out if there is anything wrong with what we already have. As a matter of fact, we all know that there has been tremendous progress in the development of AM broadcasting since it started on a large scale twenty-five years ago. Generally, it may well be said that, technically, broadcasting as it exists today is a fairly good system. This is at least the way it appears to the majority of listeners, who are probably more conscious of deficiencies in programming than of technical imperfections.

For the listener who is fortunate enough to be located under the shadow of a powerful transmitter, for the broadcaster who already enjoys a particularly good channel, for a soap opera fan who lives away from trolley lines, neon signs and other unlicensed generators of radio frequencies, broadcasting as it is today on AM, probably gives everything that is desired, at least technically speaking.

But what about the others? What about the newcomer in broadcasting who cannot get started because he cannot get one of the precious frequencies? What about the listeners who are deprived of this possible additional service for the same reason? And the many others who cannot enjoy existing service because they happen to live in urban areas of high noise level? What about the music lover who had to buy himself a phonograph and records, simply because he does not think radio reproduction is good enough?

Engineers should be the first to realize that, although in an advanced stage of progress, present broadcasting can stand considerable further technical improvement. It is, therefore, the purpose of this article to look more closely at these technical deficiencies of present broadcasting and, at the same time, see what FM on the very high frequencies can do either as a substitute or an adjunct of the present system.

Need for More Channels

Perhaps the most serious problem existing today in broadcasting is that the broadcast band is absolutely saturated. In certain areas it is literally impossible to obtain a single additional acceptable frequency. The result is that it is also impossible to expand coverage, or to establish alternate service in many sections of this country which would have a right to better service, on the basis of their population or of their resources. If the situation is already serious, how much more serious will it be in a few years, when the general growth of population will have created new communities and further developed existing cities. Already there are some 1,005 AM stations in the United States, 112 in Canada and 110 in Mexico and Cuba. For these 1,227 existing stations, there are approximately 100 channels only to be shared, and there are already another 350 stations under construction. On top of this, there is still a waiting list of at least 1,000 applicants doing everything in their power to break down existing interference safeguards so that they may also have access to what is considered a most profitable business.

Under the circumstances, the situation is serious even for stations already well established; and there is no doubt that new channels have to be found for future expansion and to relieve present congestion. Of course, the only part of the spectrum which can provide this added "lebensraum", as Hitler used to call it, is in the frequency range above 30 megacycles.

Recognizing this need, federal authorities, in both the United States and in Canada, have already assigned the band from 88 to 108 megacycles for broadcasting purposes. This band has 20 times the width of the broadcast band and were it to be used for AM, it could accommodate 2000 channels instead of the present 100. However, for other reasons to be studied shortly, wide-band FM will be used rather than AM, and on this basis only 100 new channels, will be provided. But these 100 new channels can be shared by thousands of new stations in the United States and in Canada. Obviously then, the solution to the present overcrowding of stations in the broadcast band has already been found in the opening up of the higher frequencies for broadcasting.

Static and Noise

Another important deficiency of the present AM system, with which everyone is already too familiar, is its inability to overcome static. This defect is so serious that it has been the object of a continuous search, ever since the early days of radio, in the hope of discovering some anti-static device. The curse of static is fortunately not too frequent in urban areas well served by powerful transmitters, but even then it does spoil reception for millions of listeners many times a year during electric storms. In rural districts where the signals are usually much weaker, the effect of static is much more frequent and much more serious.

The same thing is also true of the inability of AM to overcome man-made interference in populated industrial centres where, in certain areas, the use of electrical machinery practically ruins reception during most of the day. Some forms of interference are also serious in residential areas; and most residents of multi-apartment dwellings would much rather listen to the news than to the characteristic buzzes which accompany the morning shaves of their neighbours. Although in Canada we have a government department which is doing everything it can to reduce such man-made interference, this problem remains a very difficult one in most cities.

As far as the listener is concerned, this problem of static and man-made interference is probably the most apparent and annoying deficiency of our present AM system. The only thing that could be done about it until now was to increase the power of stations until their signal overrode the noise. This measure improves the signal-to-noise ratio but also increases interference with other stations, unless all stations are similarly increased in power, thus leading to an impossible economic situation.

Now, of course, we have a solution, and a beautiful one at that . . . FM on very high frequencies was perfected and presented to the world by Major Armstrong as the very cure for our static and noise problems. FM is relatively free from electrical noises, because these interfering noises generally have the characteristics of amplitude modulated signals, to which the FM system is practically deaf. In FM, the receiver has been designed to respond only to changes in frequency and not to changes in amplitude. (See Appendix) Although electrical interference contains some components which vary in frequency, these variations are rather small in comparison to the frequency deviation of the signal itself.

The total inherent advantage of FM over AM in noise rejection is about 24 to 26 decibles, or expressed in terms of power between 250 and 400 to 1. In other words, if it is necessary to move to the very high frequencies in order to find more channels, the same signal-to-noise ratio can be obtained on FM as on AM with only a small fraction of the transmitter power, say 200 instead of 50,000 watts. Or similarly, if comparable power is used, the signal-to-noise ratio can be improved as much as twenty times by using FM.

These figures are derived from theoretical considerations for fluctuating noise, but they have also been confirmed by actual field tests. For impulse noise, such as automobile ignition, FM has also a similar great advantage over AM, but specific figures cannot be given because actual gains will vary with the wave form of the impulses.

Table 1 illustrates the advantage of FM over AM for automobile interference, which is the most serious type of noise we have on very high frequencies. This table was prepared by BBC engineers on the basis of recent field tests on 45 mc. The same report states that on 90 mc. the same effect would be obtained with one third of the field strengths. It is interesting to note that horizontal polarization is much better than vertical polarization for this type of interference. And as horizontal polarization is to be used in this country, only the second and last column should be compared.

But the most important fact to note is that on FM, cars can be only one fifth of the distance away to cause the same trouble as on AM for high values of field strength. For the low signal values which are still usable on FM, the internal noise in the AM set was already so high that it masked the automobile interference.

Interstation Interference

Another troublesome characteristic of the present AM system is the interference which is heard so frequently between stations operating on the same channel. Both the desired and the interfering stations are heard through the receiver at a loudness proportional to their relative strength at the antenna. Thus, as the interfering signal is decreased, the audible interference continues to be heard but at a proportionally reduced level, until the interfering signal is approximately one per cent of the desired signal, when it ceases to be troublesome. On FM, however, the desired signal suppresses the undesired signal, provided the interference is less than ten per cent of the desired signal. The interference may even be increased to 30 per cent before it becomes intelligible, but the resulting noise under these conditions does mar reception to a certain extent.

In any case, it is safe to state that a ratio of 10 to 1 is quite acceptable for FM, while 100 to 1 is needed for AM. This is a ten fold improvement in favour of FM, or 20 decibels. In addition, there is the further improvement contributed by the absence of sky-wave on very high frequencies. Unlike stations on the broadcast band, which at night can interfere with other stations thousands of miles away, the interference range of very high frequency stations is in the neighbourhood of only 200 miles.

It follows that, with the advantage of FM with respect to inter-station interference and with the very short interference range of very high frequencies, it is possible to locate stations operating on the same frequency much closer together. Thus, in the Canadian allocation plan, frequencies which are used in Montreal can be used again in Belleville and Toronto and again at intervals of a few hundred miles across the country. This obviously multiplies the number of stations which can be assigned on a fixed number of frequencies.

Fidelity of Reproduction

Another important and controversial question in the FM vs AM picture is the matter of fidelity of reproduction. Generally speaking, except for custom built models, even the best AM receivers reproduce only a small section of the audio spectrum under normal conditions. This condition is illustrated in Fig. 2,

TABLE I

Comparison of FM and AM Systems for Susceptibility to Automobile Ignition Interference
(From BBC Quarterly Review, Page 65, Volume 1, No. 2)

Field Strength 45 Mc/s Half-wavelength dipole 30 feet above ground	*Extinction Distance*		
	F.M.		A.M.
	Horizontal polarisation	Vertical polarisation	Horizontal polarisation
50 μV/m	200 yards	>200 yards	At 100 yards the ignition was very disturbing, but merged into the set noise, which was very high.
100 "	150 "	200 "	
300 "	80 "	120 "	As above, but less disturbing.
500 "	60 "	120 "	Perceptible at 100 yards but merging into the set noise.
1000 "	40 "	80 "	190 yards
5000 "	25 "	50 "	120 "

which shows the frequency range of various sounds and musical instruments as compared to the limits of reproduction of average receivers.

Thus it can be seen that the faithful reproduction of orchestral music would require a range of 30 to 16,000 cycles, while the average console receiver passes effectively only from 100 to 400 cycles. For the table models the range of reproduction is even more limited. Frankly, the general public is perhaps not very conscious of these limitations, as the ears of the listener seem to have become accustomed to this lack of fidelity. It is of course granted that, in the transmission of voice and dance music, which by public demand constitutes a major portion of the broadcasting fare, the frequency limitations already mentioned may not appreciably affect the enjoyment of the programme.

There can be no doubt that in the case of certain modern orchestrations, the narrower the frequency range the greater the enjoyment, and this is valid even to the point when there is no range and no music left at all. But, if poor music may actually be improved with reduced range, and if a good joke can be just as funny on a cheap miniature as on an expensive high fidelity set, it would be difficult to argue that the average radio reproduction of music could not be improved a great deal yet.

It should be pointed out at this stage that the narrow range of reproduction of AM receivers is the inevitable result of the present AM allocation pattern, and cannot be improved under the present system. The 10 kilocycle separation between stations imposes a practical limit of 5000 cycles on fidelity, specially when the tone control has to be used already to reduce the background noise.

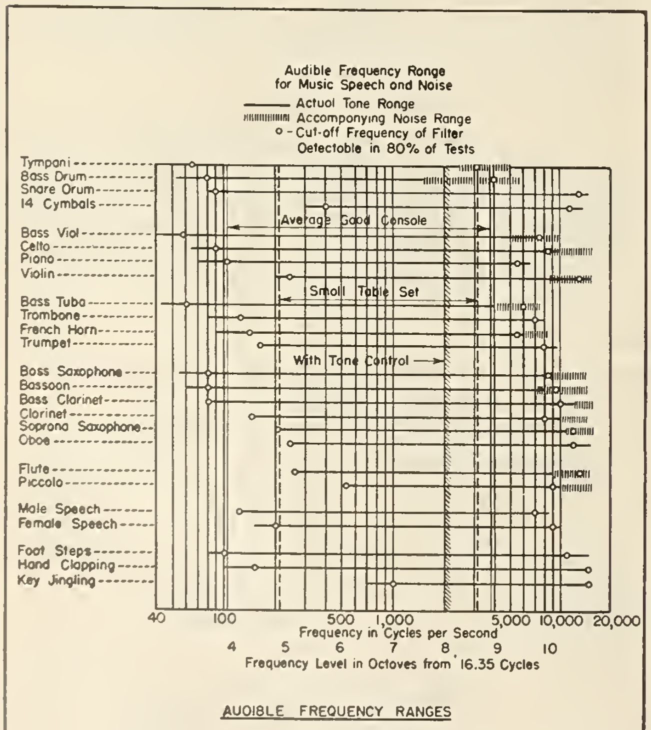

Fig. 2—Frequency range of musical instruments (from Pender and McIlwain Electrical Engineering Handbook)—reproduction range of typical receivers added by author.

On the other hand, on very high frequencies, the frequency separation between stations can be as great as needed, and, with FM, noise is no problem, so that the listener can have all the fidelity he can afford. The word " afford " is used here intentionally rather than the word " desire ", because high fidelity will cost more, there is no doubt about it. The important thing, however, is that on FM the listener can have the best in musical entertainment if he wants it and can afford it. With present radio, however, he generally cannot get it even if he wants it and can afford it.

Furthermore, good audio frequency range is not the only requirement of good reproduction. Present AM broadcasting also reduces the dynamic range, that is, the volume contrast of the reproduction. This is because it is necessary to raise the lower passages so that they may be heard above the noise level of the system. In FM, with its lower inherent noise, this range compression will not be necessary to the same extent. Thus, if desired, the audio contrast can be increased more than ten times with FM. It should be pointed out, however, that if advantage is taken of the lower noise of FM to increase dynamic range, it cannot at the same time be used to increase coverage, or to reduce the power of transmitters. In all, there are some 25 decibels of possible improvement which can be divided up as desired between coverage, dynamic range or power reduction.

In the FM-AM debate, the question of fidelity is probably the most controversial one, because it deals more or less with individual taste and appreciation. And on such subjective reactions, opinions can obviously be divided. But no matter what individual reactions happen to be, it should be remembered that the question of fidelity or " infidelity " would have little bearing on the acceptance or non-acceptance of FM as an overall system. The other advantages of FM, which have already been reviewed, should be quite sufficient in themselves to assure its wide acceptance.

The question of fidelity in FM is rather that, given an FM system, is it really worth-while to spend a little more to really give it good fidelity? The legislators have already ruled on that question as far as the transmitter end is concerned, and FM broadcasters will have to install equipment capable of transmitting practically the whole audio spectrum with a minimum of noise and distortion. Now this is of no use unless the receiving end is also reasonably good. If the listener does not like a true reproduction and wishes to improve on the real thing, he should do so himself and, for that purpose, the engineer should provide him with the necessary tone controls. The function of the engineer is certainly not to develop new musical instruments.

Thus the defects of our present system, the extreme congestion in the broadcast band, its susceptibility to parasitics and interstation interference and the relatively poor fidelity of reproduction, find in FM on very high frequencies an excellent solution. But FM has other advantages, such as economy in transmitter construction and operation. While an AM transmitter must be designed to carry peak powers of four times the carrier power, the FM transmitter has to carry only the carrier power itself which remains constant. This and other circuit features result in smaller and cheaper units as well as in economy in tube and power consumption.

Possible Limitations

But this is probably enough on the good points of

FM and, inasmuch as there is definitely an AM-FM controversy, it is due time to look at the other side of the ledger. Fortunately here there does not seem to be anything very serious.

First of all, FM got off to a bad start, from which it has had some difficulty in recovering, when a long time ago radio theorists proved mathematically that it was not so good. But that was narrow band FM on medium frequencies, and some of the experts were undoubtedly right as far as they went. F.M.'s advantages in noise reduction under these conditions were too slight to compensate for the probability of rather bad distortion due to selective fading on skywave reception. But FM broadcasting considered today is not narrow band FM on medium frequencies, but wide band FM on very high frequencies, where there is no skywave and where the noise improvement can be ten times as great.

On very high frequencies, because there is no skywave, and because very high frequency propagation tends to follow the line of sight, it will not be possible to get the same coverage from a single station as is possible on the broadcast band on a good channel and with good ground conductivity. However, this limitation in range is a blessing in disguise, as it contributes to the reduction of inter-station interference, as we have already seen. On AM, under favourable ground conditions, it is possible to have extended coverage, provided stations are protected against interference by wide geographical separation, that is, by using only a limited number of stations. That is what is done on clear channels. On FM, in the very high frequency band, coverage will be samewhat less. As it has already been shown, this apparent loss is compensated by the possibility of using more stations and, of course, by the other extremely important advantages of FM in noiseless and realistic reception.

In any case, this limitation of range is a factor which is of concern only to the broadcaster. In so far as the listener is concerned, it makes no difference whether the service he obtains is from a distant station, or from one half the distance away, as long as he gets the service. On that basis, there is no doubt that FM service, with its higher inherent faithfulness and noiselessness, appears to be the ultimate in broadcasting even for areas of scattered population, if the broadcasters can eventually afford the extra stations required. In the meantime regional stations operating on the better AM frequencies will probably continue as the economical method of serving rural areas. On the other hand service in cities and other areas of concentrated populations can best be carried on FM. Actually, many existing AM stations on some of the Class III and Class IV channels will improve their coverage by going to FM, not to mention again the better service to the listener in improved quality and reduced noise. As local coverage gradually shifts from the broadcast band to the very high frequencies on FM, the congestion on the broadcast band itself will decrease, thus releasing additional channels for improving coverage of rural areas and outlying regions.

Another possible disadvantage of the very high frequency quasi-line of sight propagation are the shadows which are cast by hills, mountains or steel structures. Fortunately these shadows are not completely black due to diffraction and reflection. Their extent can be reduced to a reasonable minimum by proper selection of the transmitting site, and by the use of as high an aerial as possible. In this respect the requirements of antenna height for very high frequencies are probably less stringent than for standard broadcasting, where radiating structures of 300 to 600 ft. are the rule rather than the exception.

Another phenomenon peculiar to very high frequencies is what is called " bursts ". These are bursts of interference from distant stations. Reflection from meteoric clouds has been given as a possible explanation for these bursts. They seem to last only a very short time, and for the moment at least are seldom heard.

Then there is the possibility of multipath distortion, which may affect FM on very high frequencies in mountainous country or in cities with high buildings. This distortion is caused when strong reflections arriving over a much longer path interfere with the direct wave at the receiver. Fortunately this difficulty, which occurs only under special conditions, can usually be entirely eliminated by moving the antenna a few feet one way or the other.

Opposition to FM

Mention has been made of these characteristics of high frequency propagation to give as complete a picture as possible. But these are seldom used as arguments against FM on very high frequencies. Most of those who oppose FM do so because they are satisfied with what they have now. Some broadcasters already on good AM channels not only see in FM little advantage to themselves, but also fear a possible threat to their present favourable positions. This refers generally to conditions in the United States, as well as in Canada. Similarly, some manufacturers see in FM a new element of competition, which may weaken their present advantageous situation. The listening public itself wants to be reassured that a too rapid transition to FM will not render AM receivers obsolete.

Again, even if FM is the solution to many of the present troubles in local broadcasting, there is the cost and risk of the change-over itself, which is a strong factor in slowing down normal progress. Manufacturers are not too anxious to produce sets unless there are already programmes on the air on FM. Similarly, broadcasters do not see why they should invest large sums in FM programmes when there are no sets to receive them. It is the old chicken and egg routine. Which should come first, the chicken or the egg? In addition to this, the musicians' union in the United States is making things even tougher by preventing in effect the duplication of musical programmes on both AM and FM.

But all these difficulties do not alter in any way the fact that a solution is needed to present broadcast band difficulties, and that FM on very high frequencies appears to be the best solution. The present opposition to FM is only a normal reaction to the economic and social re-adjustments which accompany all important technological developments. This situation is a challenge to the engineers who must assume their full responsibilities in achieving what they believe is technically correct, in spite of annoying opposition based on side issues. This duty falls equally on all radio engineers whether they are engaged in radio legislation, manufacturing, or broadcasting. If there must be a period of transition between AM and FM, it should be assured that this transition is brought about as efficiently and smoothly as possible. It might be of interest at this point to examine what these three engineering groups have done or have yet to do about FM.

Legislative Aspects

First the legislative side. Both in the U.S. and in Canada, definite allocation plans and engineering standards have now been completed by the federal authorities concerned. These allocation plans assign specific channels to specific cities or areas so that the most efficient use of the FM spectrum may be made at all times. This allocation plan provides for roughly 50 per cent more FM stations than there are AM stations already in any particular centre, and generally provides in addition a channel for every community of 5000 or more population. This allocation plan has been developed on the basis of normal maximum effective radiated powers of 20 kw. to 500 ft., and on standards of interference which will give full protection to the 100 microvolt per metre contours.

Because it was already at war when FM started in the United States in the 50 megacycle band, Canada will not have the economic and technical difficulties of changing over from low band FM to high band FM. In the United States, this conversion, which rendered a few hundred thousand low band FM receivers obsolete, will cost some $75 millions. This early and radical change in standards of FM, which Canadian listeners and broadcasters have luckily escaped, illustrates why it is sometimes wise not to jump too fast into a rapidly moving technical field, even when everyone else expects you to do so. But more about this later when dealing with television.

The important thing now is that a complete allocation plan for FM in Canada has now been made, and existing AM license holders have been invited to apply for FM licenses as soon as possible. When the authorities know how many of the existing stations are interested in FM, applications from others not already in broadcasting will be dealt with. To encourage broadcasters to make an early start, experimental licenses will be granted for operation on 250 watts, without the necessity for the filing of the usual exhaustive engineering brief. There is no intention to impose this figure of 250 watts as a general power ceiling, as some had misunderstood it. Rather, it is an interim measure to permit an earlier start in FM while the necessary engineering data may be gathered for the preparation of applications for higher powers, and until manufacturers can supply equipment of higher power and, above all, FM receiving sets.

Responsibilities of Manufacturers

Now, let us assess the responsibilities of the manufacturers in the establishment of FM. If there are yet no receivers on the Canadian market and practically none in the United States, in the author's opinion it is not because manufacturers are holding up FM, as some have suggested. It is rather because it takes time to engineer for mass production the delicate circuits which make up an FM receiver. It must be remembered that the prewar designs on the low FM band are now obsolete, and brand new designs had to be developed. In the meantime, production lines which were idle since the demand for military equipment has ceased, have been kept busy turning out AM receivers which offered no real problems. Of course, this delay in the manufacture of FM sets does not help to get FM moving. But this delay is extremely preferable to the early flooding of the market with cheap FM receivers, which would not do justice to the possibilities of FM.

The inherent advantages of FM with respect to interference and quality of reproduction depend on the use of efficient limiters, good audio systems and generally stable circuits. At this stage of development of the art, such an FM receiver simply cannot be made for $19.95. Perhaps this will come some day, but it is not here yet. In the United States, serious damage was done to pre-war FM by the sale of such receivers which could receive FM, but with no advantage over regular receivers as far as noise and quality were concerned.

It is clearly the duty of radio manufacturing engineers to make sure that the essential advantages of FM are realized in practice. First of all, it is their duty to see that the public is made conscious of these greater possibilities of the new system. In that connection it is interesting to note that Canadian manufacturers seem to be keenly aware of the danger of the cheap FM set, and it is understood that they will concentrate on the manufacture of the better models. No doubt this policy reveals the influence of engineering thought over usual merchandising methods. It should not be too much to hope that the same engineering thought will permeate through to the retailing levels, where FM for the first time comes in contact with the public.

Responsibilities of Broadcasters

If the best FM programme will sound no better on a cheap or poorly designed FM receiver than on AM miniatures, it is also true that the best FM receivers cannot turn out fine music when receiving programmes from worn-out phonograph records. So broadcasters also have their FM responsibilities. It is not enough to invest in a low power FM transmitter as a sort of insurance against possible future developments. When the listener has made a substantial investment in a better receiver he will very reasonably expect greater enjoyment out of it. And he will be disappointed if the clarity of FM serves only to lay bare the technical imperfections of existing programmes.

Many technical deficiencies in our present AM studio equipment and acoustics will have to be corrected for high quality FM. The audio range of transmission of radio networks will have to be improved. Efforts in this direction have already started, and in Canada the wire and telephone companies will soon be ready to meet the demand of broadcasting in this respect. As far as the CBC is concerned, it hopes to have high fidelity circuits to link its FM installations in Montreal, Ottawa and Toronto, sometime in 1947.

Another responsibility of the broadcasters is the use of sufficient effective radiated power on FM to give a true basis of comparison with standard AM. In other words, it would hardly be fair to expect FM to satisfy the listener, if it is only given 250 watts to match the performance of its big AM brother of 50,000 watts. Putting it another way, if all the inherent advantage of FM in improved signal-to-noise ratio are used up by the broadcaster to save on original cost, there will be little advantage left for the listener.

What the CBC Plans for FM

At this time of writing there are three FM stations in operation in Canada on the FM broadcast band. All three are experimental stations owned and operated by the CBC. Two of them are in Montreal, one relaying programmes from the Trans-Canada and the other from the French network. These two stations are located temporarily at CBC Engineering Headquarters in downtown Montreal, until the proposed permanent CBM FM and television station is built on top of Mount Royal. This location will be an ideal one for high frequency service, giving the best possible coverage to the city and its surroundings.

The third FM transmitter already in operation is the CBC Toronto station, which is located on the top of the Bank of Commerce building. This building, which is the highest structure in Toronto, constitutes the best possible location for maximum FM coverage in that city. Plans are already well under way for similar installations in Vancouver, Ottawa and Winnipeg as soon as equipment already on order becomes available.

The CBC sincerely hopes that private stations throughout Canada will also realize the tremendous potentialities of FM towards improved service and that, through the joint efforts of the private stations and of the CBC, most Canadian centres may within a few years enjoy FM transmission.

It can, therefore, be seen that the CBC is quite enthusiastic about FM. It is already a well known fact that the present broadcast band will not meet Canada's need for more stations. It is also known that only the very high frequencies can provide the additional channels required. Because of their particular propagation characteristics, very high frequencies can best be used, at least at the start, for improving local service, at the same time relieving congestion on the standard band, this in turn permitting improvement in rural service.

From theoretical consideration and from results of actual tests, it is also known that on very high frequencies FM is far better than AM, for freedom of interference of all sorts and for improved quality. With these convictions, and in the absence of any serious economic difficulties, the CBC can do nothing else than encourage the rapid development of FM for the better service of the Canadian public.

Television

In view of the recent television developments in the United States, and at the request of its Board of Governors, the CBC is currently engaged in a very thorough study to determine under what conditions television can be inaugurated in Canada at the earliest possible date. It is of course too early yet to say just when the CBC may give the " go ahead " signal in television. First the CBC must determine at what phase in its rapidly evolving development the new art can most efficiently and economically be fitted in the broadcasting and economic pattern of Canadian life.

Technically, television is already quite good. Some think that it is developing much too fast. Just when black-and-white decides that it is ready to make the big jump from experiment to regular service, colour television had to make its appearance. As a result of this indiscretion, the American radio industry is again divided into two camps—those who will go ahead with black-and-white anyway, and those who have decided to wait for colour. Both sides of the issue have their followings, not only in the manufacturing industry, but amongst the broadcasters and amongst the public as well; both sides are going all out to prove their case with all the effectiveness of modern advertising and publicity behind them.

In the United States, and apparently in Canada also, if you appear to favour one side, you are damned by the other, and vice versa; and if you are reserving judgment until the issue can be judged under more propitious conditions, you simply get it from both sides. The facts are that, when demonstrated under controlled conditions in the laboratory, television in black-and-white is technically good, but television in colour is more pleasing. However, under practical conditions, black-and-white television seems to be ready for home use, while colour television may not be. In the United States, proponents of colour claim that if everyone would get behind it instead of fighting it, color television might be ready in a year or two. But its opponents say it will surely take another five years, perhaps ten. In any case, the FCC, apparently satisfied that black-and-white was good enough and ready to go, has given the " go-ahead " for commercial operations. At the same time the colour interests are rushing all necessary preliminaries in an effort to obtain a similar approval for their system.

In Britain the BBC has decided to use black-and-white while colour is being developed. It should be remembered that both England and the United States had black-and-white service, with a few transmitters and a few thousand receivers even before the war. These represented, in addition to their development cost, a sizable investment. In Canada, consideration of past investment and of obsolescence of equipment on hand does not enter in the picture. We are, therefore, perfectly free to look with a certain detachment on the turn of events across the border. Should we act too quickly, we would risk leading the Canadian public into a considerable investment in a system which may possibly last only a few years. But the way things are moving, patience for a few more months will undoubtedly greatly reduce this risk. Then we should be in a much better position to decide wisely which way we should go technically. " Technically " is used here advisedly, because the technical progress of television is far ahead of its programming techniques, or of any satisfactory solution of the economic problems associated with its introduction.

The present black-and-white picture on a modern receiver is bright enough to be seen comfortably in daylight. It is steady and without flicker. Its size varies from 4½ in. x 5⅝ in. to 15 in. x 20 in., for which the public will pay in the United States between $300 and $2,500 for any machine worth the investment. It is by no means perfect yet, lacking somewhat in contrast and with a definition like an 8 mm. home movie, under good conditions.

But this picture seems to be quite good enough to permit the enjoyment of most programmes, particularly sports. Unfortunately, at this early stage of development of the art, the quality of programmes varies a great deal. It is the same situation as in the early days of sound broadcasting. As television matures it will gradually develop new techniques and new ideas which will make more efficient use of the vast potentialities of the new medium. Although the future looks bright, much has yet to be accomplished in this particular field.

Yet the problems of television programming are nothing compared to those of television financing, that is, the overall economics of television rather than the particularly attractive possibilities which it might offer to certain specific groups within the industry.

In the United States, by mutual agreement the black-and-white proponents amongst the manufacturing, broadcasting and advertising agencies have now decided that television is ready for exploitation. There the problem of cost has been dealt with in

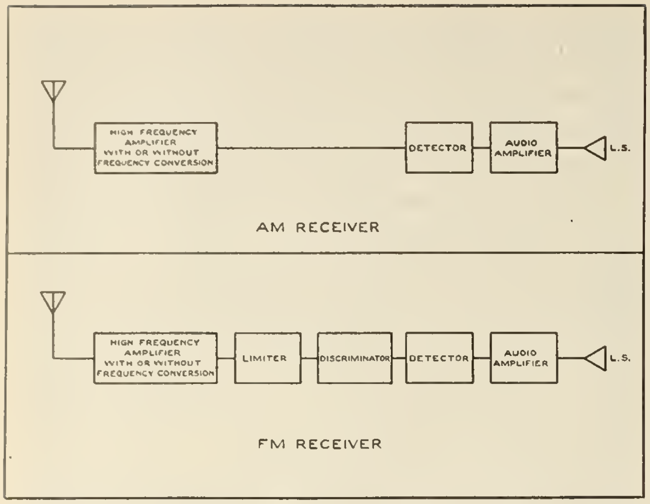

Fig. 3—Simplified circuit line-up of AM and FM receivers.

a way which Canada can well envy, but which Canada seems to be in no position to copy. Everyone in the American television industry well knows that the cost of a full fledged national television service will dwarf the already exorbitant economics of present sound broadcasting, with its $25,000 an hour cost for talent alone. But who is going to foot the bill? The public, of course, and no doubt the public will get its money's worth eventually.

Just how much it may cost or how the public will finance it, the Americans are quite frank to admit they do not know, but they will find out. There is, however, one thing certain, that the cost for an identical television service can be far less for the United States with its 135 million population and its 3 million square miles, or for Great Britain with its 45 million population and its 89 thousand square miles, than for Canada with its 12 million people and its 3½ million square miles. If only a single television station could be made to cover the whole population of Canada in one shot without networks, time zones and language difficulties, then the question of costs would be a simple one.

Yet, that is exactly what the Americans can do in the New York area, where the population within the coverage of a single transmitter is more than our own Canadian population spread over half a continent. If we compare wealth instead of population, the comparison is even more staggering. The comparison with conditions in England is equally illuminating. How easy it would be for us to concentrate on an area only 150 miles wide and extending between Windsor and Montreal and forget about the rest of the country. In addition, to make things still simpler, instead of the 4½ million Canadian people we actually have in this strip, let us assume ten times this number, or 45 million people. Then surely the economics of television would be simple; just as simple, or as complex, as in Great Britain where such conditions actually exist. So let us not be too surprised if Canada actually lags today behind England and the United States in television. It cannot be otherwise, because our own decision must be based on economic and geographical conditions as they are in Canada, and not as they are in other countries.

There is no doubt that, given an already established television programme service, enough receivers could be sold to make it a worth-while venture from a manufacturing or sales standpoint. At a high sales cost per unit of $300 to $2,500 in the United States, it may not take a very large turn-over to establish a reasonable margin of profit. But how many receivers will it take and how much will each television set owner have to pay, directly or indirectly, to make it economically possible for the broadcaster to build, operate and provide an adequate Canadian programme service to the stations we have already assumed to exist? For sound broadcasting it costs the American radio home approximately $12.50 a year for his programmes, which he pays for indirectly through advertising. In Canada the set owner pays about $10.00 for his programme service, $2.50 directly in licence fee and $7.50 indirectly in advertising. In England, the cost is $4.50 paid directly as a licence fee. Although these figures are not directly comparable because of the wide difference in population between the three countries, they might be of interest at this time as a basis to arrive at possible television costs.

Various estimates claim that television broadcasting will cost from 3 to 10 times as much as ordinary sound broadcasting, which for Canada is approximately $10.00 per radio home per year. On that basis, television service would cost each television home from $30 to $100 a year more or less. A little more if the listener or rather the televiewer pays it in small instalments every time he washes his teeth or his underwear; a little less if he pays it all at one time for a licence fee. If you add to this annual operating cost, the maintenance and depreciation of the receiver, which will cost on an average at least $500, the total is nothing to take lightly, especially if there is no guarantee against rapid obsolescence. Taking a life of 5 years for the receiver, the total annual cost will be roughly $150 to $220 a year including both receiver and programme costs. For anyone who realizes the potentialities of television, this should not appear out of line with the enjoyment it may create. But it does lift television bodily out of the realm of technical achievements into the realm of social and economic problems.

No wonder those who have the responsibility of making the decisions appear to be moving slowly. It is your money that is involved, and they simply want to be sure that it will be spent wisely in bringing you the enjoyment of television as soon and as economically as possible.

Appendix

Noise Susceptibility of AM and FM Systems

In order to understand the characteristic behaviour

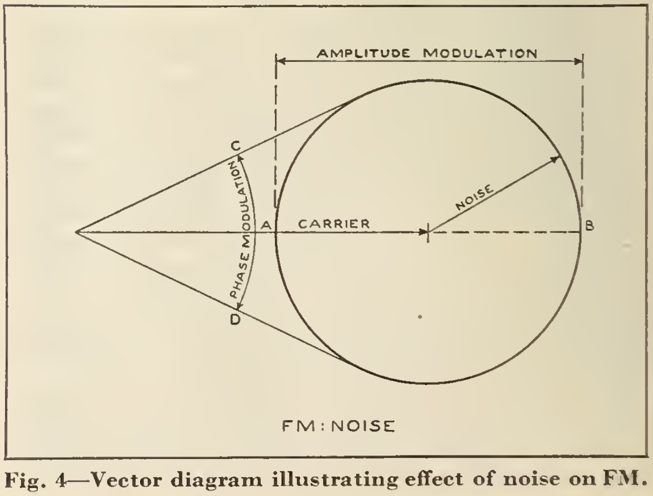

Fig. 4—Vector diagram illustrating effect of noise on FM.

of AM and FM systems in the presence of noise, it is first necessary to compare the circuits of the receivers used for the two systems, as shown in Figure 3. In both cases the radio signal picked up by the antenna is first amplified, with or without frequency conversion. In AM, this amplified high frequency signal is immediately detected or changed into the audio frequencies which actuate the speaker. In FM the amplified high frequency signal first goes through a limiter, which chops off all amplitude variations above a certain maximum value, but leaves the frequency variations unchanged. It is immediately apparent that this limiter will at the same time block most of the noise, which would otherwise go through the system. The use of an amplitude limiter is possible on FM because changes in amplitude are accidental or incidental to the system and convey no intelligence.

A further difference between the FM and AM sets is the introduction of the discriminator. This circuit is necessary to change the frequency modulated signal into an amplitude-modulated one, to permit its detection in the usual way.

The use of the limiter does not remove all the interfering noise. The reason for this can be shown by the vector diagram in Figure 4. Radio noise consists of closely overlapping impulses of random amplitude, frequency and phase. In other words, it can be considered as a number of individual carriers of random characteristics. This diagram shows the FM carrier vector and any one of the numerous noise vectors just mentioned. The desired carrier-vector rotates continuously and the noise vector also rotates continually around it. However, since we are only concerned here with the interaction of the two signals, we can picture the desired carrier as static. The noise vector rotates at a frequency equal to the difference in frequency and the carrier and the noise impulse considered.

This rotation produces amplitude modulation between A and B, and phase modulation between C and D. For signals greater than a certain minimum value the amplitude modulation is eliminated by the limiter, but the phase modulation due to noise remains. This phase modulation takes place at the speed of rotation of the noise vector, thus producing frequency modulation, which in turn produces an audible noise in the FM set, which will be proportional to frequency.

Figure 5 illustrates the magnitude of the noise components in AM and FM systems as a function of frequency. On AM, the noise is the same at all frequencies, but the ear and the audio and intermediate frequency amplifiers cut everything above approximately 15,000 cycles, so that on AM the total noise spectrum corresponds to the rectangle ABDC. In other words, AM has a rectangular noise spectrum. On FM, it has already been seen that the noise is proportional to frequency, so that it is zero for

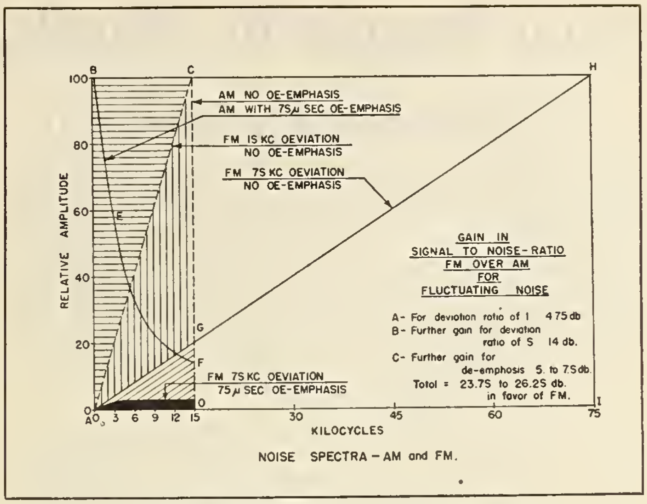

Fig. 5—Noise spectra of AM and FM.

frequency, zero and maximum for maximum deviation. The FM noise spectrum is, therefore, triangular in shape, as is indicated by the triangle ACD for a deviation of 15 kc. which corresponds to a deviation ratio of 1. Since noise is measured in RMS values, the ratio of AM noise to FM noise is equal to the square root of the squared areas of the two spectra. This immediately gives FM an initial advantage of 4.75 db. over AM.

In the case of FM broadcasting on very high frequencies with deviations of 75 Kc., which corresponds to a deviation ratio of 5, the noise spectrum is the triangle AHI. As in the case of AM, the ear and the audio amplifier will cut off anything above 15 kilocycles, so the audible noise will be that in the small triangle AGD, which is only one fifth of the height of ACD, this gives another 5 fold improvement as compared to AM, that is, another 14 db. This makes a total of 18.75 db. which is the total gain of FM over AM operating on the same frequency, and without audio pre-emphasis, in the case of fluctuating noise.

With pre-emphasis, however, further improvement is possible, and since present FM standards call for 75 microsecond de-emphasis, this is the case we are really interested in. In this system the higher audio frequencies are pre-emphasized at the transmitter by a certain amount, and linearity is restored at the receiver by a corresponding de-emphasis. Under this condition the effective noise spectrum of AM is given by the curve BEF and the spectrum of 75 Kc. FM is given by the thin black strip AD. This de-emphasis at the receiver gives a further gain in favour of FM over AM of 5 to 7.5 db., depending on the type of programme transmitted. The total inherent advantage of FM over AM in noise rejection is, therefore, about 24 to 26 db., or expressed in terms of power, between 250 and 400 to 1.

From Month to Month

News of the Institute and other Societies, Comments and Correspondence, Elections and Transfers

ONTARIO DIVISION AUTHORIZED

At the February meeting of Council, authorization was given to the members in Ontario for the establishment of a Provincial Division as provided in By-law No. 69. The necessary support of a majority of the corporate members in the province has been secured, and now Council has transferred the proposal to the Ontario councillors with power to act. Vice-President C. E. Sisson of Toronto was appointed provisional chairman.

Mr. Sisson proposes to hold a meeting of councillors in Toronto on Saturday, May 10, after the annual meeting of the Institute, for the purposes of completing the organization and determining policy. Branches will receive further advice direct from the provisional chairman.

It has been discovered that many Ontario members have viewed with uneasiness the move to establish a division. In their minds the word " division " seemed to connote a separation from other parts of Canada, and they were disinclined to support such a move. However, it has been explained that, instead of promoting organizational division, it will promote solidarity with other provinces.

Ontario councillors present at the February 1946 annual meeting suggested that the interests of the Institute and the profession in Ontario could be developed more intensively and helpfully if the power to study the possibilities were transferred from the whole Council to a provincial division. It was explained that several things were so local in their implication, that those resident in the area were better able to understand them and to make recommendations. For example, one matter that has been discussed as an item for the division to consider is the expansion of co-operative activities between the Institute and the many other organizations in the province. Another is to consider means by which the Institute can enlarge its service to Ontario members. After all, there are now twelve branches in the province, and it is possible that their needs will be better met if some agency of the Institute is established in the area to act as a division of Headquarters.

These and other matters may be on the agenda for early meetings of the division, but members may be assured that the division will be an aid to Council and not a substitute for it.

FUNDS FOR EDUCATIONAL PURPOSES

For many years members of the Institute have spoken of the good that could be done if the Institute had funds to assist better-than-average students to complete their courses in engineering—students who otherwise might not be able to become engineers. Such a fund is now available and in use.

The Harry F. Bennett Educational Fund of The Engineering Institute of Canada serves two purposes. In the first place it commemorates the services rendered the Institute and the profession by Mr. Bennett, and secondly, it provides funds to aid engineering education in many ways. The trust deed describes the educational objectives as follows:—" The purposes and objects of the fund are to establish engineering and science scholarships and fellowships and to award the same to deserving persons, to encourage by way of financial assistance and otherwise the establishment and maintenance of engineering and science departments in schools and colleges, to make loans to deserving students to enable them to pursue engineering and scientific studies, and generally, in any way to promote and advance the study of engineering and science ".

Members will be pleased to know that the objective of $25,000.00 has been reached. The contributions from members across Canada have met the immediate needs, but the trustees and Council are hopeful that further contributions, either through the branches, or by bequests will swell the amount and make possible an increased usefulness for the fund.

Great credit is due the committee that organized the fund and collected the money. This has been one of the Institute's greatest accomplishments. It seems to be the largest financial effort ever undertaken and certainly it is one of the greatest potentials for good with which the Institute has been associated. The committee consisted of James A. Vance of Woodstock (chairman), R. E. Heartz of Montreal, and E. V. Buchanan of London. The trustees who will administer the fund and who have been proposed by Mr. Vance and Mr. Heartz are J. B. Macphail of Montreal, V. A. McKillop and E. V. Buchanan, both of London.

It is interesting to see where the money came from. The committee had prepared a quota for every branch proportionate to its membership, and therefore a comparison is simple. The outstanding effort was made in London where the branch collected $2,500.00 or 500% of its quota. London is a small branch with only 100 members of all classifications. Next in line was the Border Cities Branch where 210% of the objective was reached. Then came St. Maurice Valley with 144%, then the new branch at Kootenay with 137%, and Calgary with 134%. Five other branches also exceeded their quota in the following order: Niagara Peninsula, Quebec, Montreal, Saint John and Sault Ste. Marie. Montreal's share of the total collected was $8,000. The figures will be altered somewhat as further returns are received.

It is gratifying to note that before the trustees were prepared to appropriate money, applications for assistance began to arrive. It is interesting, too, to discover that the first recipient of assistance was a fourth year student—president of his engineering society.

Notices of the fund's existence will appear in the calendar of each university, in addition to which a small poster is being made for notice boards at universities and other appropriate places. The trustees will be pleased to receive recommendations from members who know of instances where the fund can be used to advantage. These should be sent to Headquarters.

A MESSAGE TO JUNIORS

Under the recently revised by-laws a Junior member may transfer to Member without payment of the five dollar transfer fee, providing he makes application not later than the end of the seventh year after graduation and providing too that his qualifications are accepted by Council.

It is not necessary to wait the seven years. Any Junior who has had the necessary two years of professional responsibility, and is a graduate may transfer under the same advantageous conditions any time he chooses before the end of the seven years.

Persons who do not transfer by the time specified, are required to pay the transfer fee and no person will be allowed to remain a Junior beyond the end of the eighth year after graduation except under very special conditions and upon permission of Council.

Thus it becomes apparent that graduates of 1940 are now in the last year in which they can transfer without paying the transfer fee. Already Headquarters has received many requests for transfer forms from this group, but this notice is inserted in the Journal for the benefit of those who do not know that this privilege is available to them.

ONE HUNDREDTH ANNIVERSARY

On March the third the world will pay homage to a great benefactor, Alexander Graham Bell. The controversy still wages as to whether the telephone was invented in Boston or in Brantford, but it really doesn't matter. What is important is that it was invented some place and has been a servant of man ever since. Mr. Bell wrote in 1904 " It so happens that the telephone was invented in Canada ". The confusion seems to have developed from the fact that the first telephone instrument and the first experiments were made in Boston, whereas Mr. Bell said " The first transmission of a human voice over a telegraph wire where the speaker and listener were miles apart, was in Canada ".

Mr. Bell himself was a Scotsman who came to Canada with his father in 1870. Already he had become an inventor, and his interests in sound transference began somewhere about 1862 when he was a student teacher at Weston House. Earlier his interest in sound had been developed through his father's work on speech therapeutics and phonetics, as related to methods of teaching deaf mutes to speak. A misunderstanding of the German text relating to Helmholtz experiments with electrically activated tuning forks started him off on the idea of the telephone. What a fortunate misunderstanding.

To Canadians this anniversary has a significance apart from the telephone. Mr. Bell left the telephone field, still less than forty years of age after a long series of lawsuits over patent rights, which incidentally he won, and after setting up the first telephone company. He returned to his early love—the study of deafness, and to other researches. In 1886 he purchased a property at Baddeck, N.S., where he surrounded himself with a group of bright enthusiastic young men and all became interested in powered flight—among other things. They formed the Aerial Experiment Association. The names of J. A. D. MacCurdy now of Ottawa, F. W. (Casey) Baldwin, Glen Curtiss and Selfridge are an important part of the proud record of that modest Association.

Alexander Graham Bell died at Baddeck, N.S., in 1922, and was buried on a nearby hillside with only a rough boulder to mark the spot, but actually every telephone is a monument to his intelligence, to his character, and to his indefatigable spirit.

A.I.E.E. 1947 SUMMER MEETING

Montreal, June 9-13th

Following is an outline of the programme for the meeting of the American Institute of Electrical Engineers, to be held next June at the Mount Royal Hotel, Montreal.

It will be remembered that members of the Engineering Institute have been invited to participate, and that the arrangements are being made by a joint committee of representatives of both institutes.

TENTATIVE PROGRAMME

Monday, June 9th

Morning: Registration and Meetings.
Afternoon: Meetings.

Tuesday, June 10th

Morning: Meetings.
Afternoon: Meetings and Golf—Ladies' Sightseeing Tour and Tea at Botanical Gardens.
Evening: Smoker and Ladies' Bridge.

Wednesday, June 11th

Morning: Meetings and General Session.
Afternoon: Inspection Trips and Golf—Ladies' Conducted Shopping Tour.
Evening: Free.

Thursday, June 12th

Morning: Meetings.
Afternoon: Meetings.
Evening: President's Reception and Dinner Dance.

Friday, June 13th

Morning: Meetings.
Afternoon: Meetings.
Evening: Saguenay Boat Trip. (For those unable to be accommodated on Friday, arrangements will be made on boat leaving Saturday evening).

Note: Smoker—Tuesday, June 10th, 1947. Accommodation for 1000 only. Get your reservation in early.

Wednesday, June 11th, 1947—An endeavour is being made to arrange for two plane flights to Shipshaw during the afternoon.

GET YOUR HOTEL RESERVATIONS EARLY.

HIGHLIGHTS, SAGUENAY BOAT TRIP

Orchestra on board for the trip.

Friday, June 13th, 1947—6 p.m. Boat leaves Montreal.

Saturday, June 14th, 1947—5 p.m. A trip to the Shipshaw Power Development has been arranged through the courtesy of The Aluminum Company of Canada.

Sunday, June 15th, 1947—Stop-over visits.
7.30 to 11 a.m.—Murray Bay.
3.30 to 8 p.m.—Quebec City.

Monday, June 16th, 1947—6 a.m. Arrive Montreal.

As reservations are to be filled on the basis of first come first served, you are advised to get your application in early. Please signify on the application whether or not you intend to visit the Shipshaw Plant.

For all reservations address: Mr. G. H. Gillett, Secretary-Treasurer, Summer Meeting Committee, A.I.E.E., c/o Canadian General Electric Co. Ltd., 1000 Beaver Hall Hill, Montreal, Quebec.

ART FOR THE ENGINEER

An innovation in Institute circles has been arranged for the annual meeting. There will be an arts and crafts exhibit. There will be classes for oils, water colours, pastels, photographs and many forms of handicraft. All details are not yet determined, but the special committee is working on them. This is by way of a preliminary notice.

For years officers of the Institute as they have travelled across Canada have been impressed with the number of engineers who find a cultural outlet in the arts and crafts. If all these members will show their products at Toronto, a really impressive salon will result. Besides providing a pleasant entertainment for members and guests, it will afford an opportunity for many modest beginners to get into a show perhaps for the first time.

Admittedly it is an experiment, which entails a lot of additional work and worry for the Toronto committee, but the committee believes the results will more than justify the effort.

A GREAT EDUCATIONALIST RETIRES

It is a matter of interest and concern in every part of Canada that Dr. Frederic H. Sexton has retired. For forty years he has headed up the Nova Scotia Technical College at Halifax, having been its founder in 1907.

Not many Canadians have established for themselves the record that is now Dr. Sexton's. Although his efforts have been centred in Nova Scotia, he is well and favourably known in all provinces. Through his own activities and through the loyalty and attainments of his graduates, he has become a Canadian of great distinction. No university in Canada enjoys a better reputation with employers than does Nova Scotia Tech. This is perhaps the finest tribute that could be paid to the man who has made the training of young Canadians his life work.

Dr. Sexton is a man of great breadth. His interests and his accomplishments embraced many fields. Not content with turning out engineers, he played a leading part in establishing and maintaining evening technical schools, mining schools, industrial courses, correspondence courses, apprenticeship and vocational training. All these he did in his dual capacity of president of the college and provincial director of technical education.

Dr. Sexton was born in the United States at New Boston, N.H., on June 9, 1879. He was educated at the public schools of Billerica, Mass., Cambridge English high school, and the Massachusetts Institute of Technology, graduating from the Institute in 1901 with the degree of bachelor of science in mining engineering. In 1919 he received the honorary degree of doctor of science from Acadia University and of doctor of laws from Dalhousie University.

After his graduation at MIT he was assistant in metallurgy at the Institute and research metallurgist with the General Electric Company at Schenectady, N.Y. He came to Nova Scotia in 1904 to become assistant professor of mining engineering at Dalhousie University. In 1907 he was chosen by the provincial government to found the Nova Scotia Technical College. He has been president of the college and provincial director of technical education ever since.

Dr. Sexton is a member of the Canadian Advisory Council on Vocational Education, vice-chairman of the Atlantic Coast committee of the Canadian Legion Educational Services, and a member of the Maritime Division board of directors, National Institute for the Blind. He is also a trustee of the Maritime Foundation for the Blind. He is past president of the Mining Society of Nova Scotia, the Canadian Education Association, and the Nova Scotia College of Art. He was formerly district governor of Rotary International and a member of the council of the Nova Scotia Association of Professional Engineers. In 1931-33 he was chairman of the committee which revised the Nova Scotia public school curriculum.

Dr. Sexton was awarded the Julian C. Smith Medal in 1943 by the Engineering Institute. This award is made for " achievement in the development of Canada ". It would be difficult to find a more worthy recipient.

Members of the profession everywhere will wish Dr. Sexton good health and a long life in which to enjoy the good things that he has earned by his life of service to his fellow men.

NEW PRESIDENT FOR NOVA SCOTIA TECH

Coupled with the announcement of the retirement of Dr. Sexton comes the news of the appointment of Dr. Alan E. Cameron to the post of president of the Nova Scotia Technical College.

In the minds of those who know both gentlemen, the news of Dr. Cameron's appointment largely compensates for the departure of Dr. Sexton. It is a happy circumstance that makes possible the replacement of Dr. Sexton with such an excellent and well qualified successor. Dr. Cameron is already widely known across Canada because of his work in Alberta, Ontario and Nova Scotia, and it is difficult to think of anyone whose training and natural talents would fit him more precisely for the work and opportunity that goes with this appointment.

Dr. Cameron was born at London, Ont. He received his primary and secondary education at Ottawa and graduated from McGill University in mining engineering in 1913 with honours in geology. The following year he obtained his master of science degree.

He joined the staff of the University of Alberta to develop the department of mining engineering. During the First World War he served with the Geological Survey of Canada in the Northwest Territories, was an engineer with the Imperial Munitions Board, and saw active service as a lieutenant of Engineers in France and Belgium.

At the end of the war he joined the staff of Khaki University, remaining in England with the college until it disbanded. Returning to the University of Alberta he spent six years teaching mining and metallurgy and in professional consulting work, particularly in the search for oil in Alberta and the northwest.

He attended the Massachusetts Institute of Technology in 1924-25, receiving the degree of doctor of science in metallurgy. Going back to the University of Alberta, he became associate professor and then professor of metallurgy and acted as secretary of the Research Council of Alberta.

During the next 12 years, Dr. Cameron carried on explorations in northern Alberta for the Research Council and private consulting work in the Northwest Territories. He was among the first to go into Great Bear Lake after the discovery of radium there, and the first post office for mineral developments, Cameron Bay, N.W.T., bore his name. In 1935 he ascended the South Nahanni river and explored the so-called Headless Valley and tropical valley of that area.

Dr. Cameron joined the staff of the Nova Scotia Department of Mines in 1937 as deputy minister. He has been successively president of the Association of Professional Engineers of Nova Scotia, of the Nova Scotia Mining Society, and of the Canadian Institute of Mining and Metallurgy.

At present he is chairman of the engineering education committee of the Dominion Council of Professional Engineers, chairman of committees on educational and vocational training in the coal industry and the mineral industry of the Canadian Institute of Mining and Metallurgy. Dr. Cameron joined The Engineering Institute of Canada as a Member in 1937; was on the executive of the Halifax Branch in 1941 and 1942; served on the Leonard Medal Committee for several years and was chairman in 1943; represented the Association of Professional Engineers of Nova Scotia on the Council of the Institute for 1944.

He has written many scientific and technical articles on subjects related to geology, mining and metallurgy. He prepared and presented the Nova Scotia brief to the Royal Commission on Coal in 1944.

A CANADIAN WELDING BUREAU

A new division of the Canadian Standards Association has recently come into operation on the formation of the Canadian Welding Bureau. The Canadian Standards Association undertook this work on the urgent request of a wide section of the welding and fabricating industry.

One of its principal functions will be to ensure good welding by approving shops, engineering and supervisory personnel and operators. The basis of qualification will be the welding codes and specifications prepared by the Canadian Standards Association, which association will progressively prepare and issue codes covering the whole welding field, thus avoiding a costly multiplicity of standards and specifications such as has already developed in some countries.

Approved Fabricators

The Bureau has recognized that the existence of codes is not in itself sufficient to ensure good welding, although they do form a valuable guide. For this reason and to satisfy all users and potential users of welding, approval by the Bureau is granted only to those fabricators whose welding equipment, operators, supervisory and engineering personnel satisfy the standards under which the Bureau operates.

Lists of such approved members are now in the course of preparation for release to municipal and city engineers, government departments, architects, consulting engineers, buyers and other interested parties.

The Bureau's engineering personnel is at present busily engaged in testing and according approval under arc welding standards. Codes are projected for resistance welding, gas welding and brazing.

The Bureau is being staffed by experienced welding engineers who, it is anticipated, can be of material assistance to member firms. It will be their duty to assist any firm desirous of becoming a member to meet the standards required and further to generally promote welding and its proper development and progress throughout the Dominion.

Personnel

The newly appointed General Manager of the Bureau is Mr. R. M. Gooderham, B.A.Sc., M.E., who since his graduation at Toronto University in 1926 in electrical engineering, has been closely associated with welding. On leaving university he joined the Lincoln Electric Co. of Canada Ltd., and later organized and developed the British and European business of the Lincoln group. In the early part of World War II, he became welding advisor to the British Ministry of Supply and promoted and assisted in the formation of the advisory welding service of that Ministry, and later became welding advisor to the shipbuilding branch of the Canadian Department of Munitions and Supply. In recent years he has been in private practice.

Another prominent Canadian welding engineer to join the staff of the Bureau is W. Ralph Stickney, B.A.Sc., M.E.I.C., winner of the Duggan Medal and Prize for his paper on welding to the Engineering Institute of Canada in 1943. He is a graduate engineer from Toronto University in 1936. Most of his career has been devoted to welding and he has gained a broad experience by serving with the Canadian Bridge Co. Ltd., Walkerville, where he became Welding Engineer in 1939, and more recently at Canadian Vickers Ltd., where his duties embraced a very wide field of welding applications. In addition to the permanent staff of the Bureau, there will be a Welding Bureau Board, which has recently been formed. It will direct and control the operations of the Bureau and provide through its membership a liaison with both industry and the Canadian Standards Association. Members of the Board, all of whom are prominent engineers, directors or executives are:

Colonel A. H. Cowie, M.E.I.C.; Mr. E. S. Sargeant; Mr. D. S. Lloyd, M.E.I.C.; Mr. G. P. Wilbur, M.E.I.C.; Colonel W. R. McCaffrey, M.E.I.C.; Mr. M. N. Vuchnich.

Headquarters of the Canadian Welding Bureau are at present located at 86 Bloor Street West, Toronto; that of the Canadian Standards Association in the National Research Building, Ottawa.

DETAILS OF MEMBERSHIP

For years there has been the desire to have a breakdown of the membership list of the Institute in order to discover who are the people who make up this great organization, what they do and where they live. Not long ago the Institute joined the Audit Bureau of Circulations (A.B.C.), the foremost rating organization in the publishing field. A statement on the pages of a publication that it is audited by A.B.C. is like the sterling mark on silver. To the advertiser, A.B.C. is a guarantee of "paid for" circulation, and in other ways as well is his best protection. Members of the Institute will be pleased to know that *The Engineering Journal* meets these rigid requirements.

One of the requirements of A.B.C. is that the publisher provides a complete classification of the occupations or business of his subscribers. This has made it necessary for Headquarters to survey the entire membership—a task of no mean proportions. Recently it has been completed and it is now possible to publish the whole picture in a way that will be interesting to readers and advertisers alike.

There are many interesting facts disclosed in such a breakdown. For instance, the membership embraces over 1,300 government employees at the federal, provincial and municipal levels—about 16 per cent of the total membership. Over 400 are in educational institutions. Over 1,100 are owners of their own businesses or are managers of businesses. In the electrical, mechanical and industrial fields there are over 3,500 members. Over 1,500 or 19 per cent are recent graduates or students.

Geographically, there are some interesting discoveries too. For instance the provinces of Quebec and Ontario make up 65 per cent of the total with Quebec providing slightly more than Ontario. British Columbia comes next with 486, followed by Alberta, Nova Scotia, Manitoba, New Brunswick and Saskatchewan in that order. Eight per cent of the membership lies outside of Canada.

From the tabulation shown below can be seen the great detail that has been developed. Not only does it show the industrial classification but also the nature of the work done by the engineer in each classification. In all there are 260 divisions of the membership providing a most useful, interesting but nevertheless difficult to obtain answer to the question of " who is the Engineering Institute of Canada?".

OCCUPATIONAL AND FUNCTIONAL ANALYSIS OF SUBSCRIBERS TO THE ENGINEERING JOURNAL (NOVEMBER 1946)

	1	2	3	4	5	6	7	8	9	10	Total	Percentage
Aircraft Industries	5	..	5	9	8	54	26	..	..	..	108	1.3
Chemical Industries	7	13	20	11	8	35	59	5	..	..	158	1.9
Communications & Transportation	24	10	52	36	6	17	243	2	..	..	391	4.7
Construction Materials Industries	27	12	19	10	3	8	22	9	..	..	110	1.3
Consulting Engineering Firms & Engineers in Private Practice	396	..	13	11	7	89	47	2	..	..	565	6.8
Contracting Engineering Firms	144	10	41	17	3	43	106	3	..	..	367	4.4
Educational Institutions, Associations & Libraries	..	..	..	..	..	..	..	..	407	..	407	4.9
Electrical Manufacturers	29	7	57	10	3	31	168	58	..	..	363	4.4
Federal Government	16	10	83	23	7	84	435	4	..	..	662	8.0
Food Products Industries	3	2	4	11	..	..	22	..	..	..	42	0.5
Industrial Services & Supplies	81	2	41	15	2	18	74	24	..	..	257	3.1
Marine & Shipbuilding Industries	12	3	3	4	2	4	13	3	..	..	44	0.5
Metal Products Industries	98	36	93	72	36	152	218	49	..	..	754	9.1
Mining Industries	14	5	13	6	3	18	40	..	..	..	99	1.2
Miscellaneous Industries (not otherwise classified)	73	5	33	31	2	16	72	11	..	..	243	2.9
Municipal Governments	23	2	114	5	4	20	123	..	..	..	291	3.5
Petroleum Industries	10	6	22	9	5	26	90	16	..	..	184	2.2
Power Companies & Public-owned Power Utilities	32	10	64	22	6	37	247	6	..	..	424	5.1
Plastics Industries	3	1	4	3	..	10	17	1	..	..	39	0.4
Provincial Governments	13	..	34	29	2	22	281	..	..	..	381	4.6
Pulp and Paper Industries	23	12	39	45	6	25	137	..	..	..	287	3.5
Recent Graduates and Undergraduates	..	..	..	..	..	..	..	..	..	1554	1554	18.9
Textile Industries	6	1	..	9	..	2	11	..	..	..	29	0.4
Wood Products Industries	5	..	2	1	..	1	4	..	..	..	13	0.2
Unclassified	..	..	..	..	..	..	..	..	..	277	277	3.3
Retired	..	..	..	..	..	..	..	..	..	243	243	2.9
										GRAND TOTAL:	8292	100

LEGEND:
1. Owners, Corporate Executives, General Managers, and their Assistants. Town Managers.
2. Works Managers and General Superintendents.
3. Department Heads, Superintendents, City or Town Engineers.
4. Chief Engineers and Plant Engineers.
5. Chief Designers, Chief Draughtsmen, and other Heads of Design, Development or Research Departments.
6. Designers, Draughtsmen and other Employees of Design, Development or Research Departments.
7. Staff Engineers—Field Engrs., District Engrs., Asst. Engrs., Division Engrs., Jr. Engrs., County Engrs., Industrial Engrs.
8. Sales and Service Engineers.
9. Professors, Instructors, Editors and Librarians.
10. Retired, Recent Graduates, Undergraduates, Unclassified.

COMMUNITY PLANNING IN BRITAIN

A curious thing about community planning is that it never seems to get beyond the planning stage. One is surely reminded of Mark Twain's comment on the weather. Experts offer a number of reasons for this lack of action. To the average citizen most of them sound ridiculous and at times fantastic and yet the fact remains that selfish personal interests, inter-community differences of opinion, and an overall lack of objective thinking is blocking progress.

Plans, both comprehensive and sectional, are being made for several municipalities in Canada, but reports indicate that even now, most, if not all of them, are in pigeon-holes or are on their way there. All this in spite of the fact that the federal and provincial governments are giving encouragement in many forms, and are even urging that their offers of financial assistance be accepted. What is wrong?

The condition is not peculiar to Canada, but one can appreciate that the difficulties in Britain for example, may be more real than here. Over there the labour and materials situation is really serious, but still they are making efforts to overcome the other obstacles as well. A bill which in its scope is staggering was published in London on January 8th under the title "The Town and Country Planning Bill". It may have passed its second reading in the House of Commons by now.

The bill proposes to sweep away a lot of privileges which up to now have been thought to be the inalienable rights of the citizen. It proposes to reduce the privileges of the individual in the interests of the community. It recognizes the almost impossible task of getting anything done under present circumstances. If it is accepted without being shorn of its strong points, it may make the "new city" a possibility.

Already, strong opposition has made itself apparent, and it is too much to hope that the millennium has occurred, but it is interesting and encouraging to planners and broad-minded citizens here to know that someone somewhere has the courage to face the situation and to at least try to block the stupid and selfish obstructionist whose interest is not that of the community.

Here follows an outline of what the bill proposes to do. The information has been supplied by the United Kingdom Information Office.

Land Planning in Britain

The Town and Country Planning Bill is the consummation of years of inquiry by successive governments into the problems of using land to the best national advantage.

The Bill's main objects are to set up a planning system to meet present day requirements, to produce a comprehensive solution of the problem of development values in land and thereby to remove one of the main obstacles to good planning, and to provide national grants of money to help local authorities in the purchase and clearing of land for the execution of plans.

The Bill sets up a new system which, in the view of the Government, makes practical for the first time such projects as the reconstruction and redevelopment of old towns, the preservation of green belts around towns, the provision of open spaces in crowded areas, and the allocation of land in the right place for new houses and factories etc., as exemplified in the Abercrombie plan for London and similar projects for other cities. Such things have been impossible hitherto because of the heavy compensation due to landowners from local authorities, and because of the static and rigid planning system which gave undue emphasis to local at the expense of regional and national needs.

The Bill does not nationalize land, but deprives landowners of the right to build on their land except in accordance with planning requirements. A development charge (betterment) will be imposed on the owner if he is granted permission to build, thus depriving him of what is called unearned increment in land values. The Government hold that owners who thereby lose development value are not necessarily entitled to compensation. The Government recognize, however, that if no payments were made, hardships would often be caused, and have decided that a capital sum of $1,200,000,000 be made available from which payments may be made to landowners throughout Britain.

Landowners are to be left in enjoyment of the existing use value of their land. The private land developer would have to pay part of the price of the land to the Central Land Board as a development charge. The cost of land to the developer would be much the same as now, but a landowner in a key position would not be able to hold him to ransom. Private development would, as now, have to be in accordance with local and national planning requirements. If the developer is the landowner himself, he would pay the development charge.

The Government propose a positive system of planning in place of the present negative and restrictive machinery. Local authorities would be obliged to submit development plans within three years, to be reviewed at least every five years for adaptation to changing conditions. County Councils would for the first time receive direct planning functions, so that the requirements of town and country would be coordinated over a wider area than hitherto. Local councils within the counties would be fully consulted, and the carrying out of the plan, including building whether by private or public enterprise, would remain their responsibility. Where regional planning overlaps county boundaries, the counties (which include cities administered as counties) would be able to form joint planning boards. The Minister of Town and Country Planning would co-ordinate on the national plane.

The Bill provides full powers for the public purchase of land required for carrying out a plan, and provides a national grant to local authorities for loss on redevelopment operations, for compulsory purchase where they reduce the value of land they buy by putting it to less profitable use, and for payments to the landowner if the value of his land is reduced below its existing value. All purchases of land for public use, whether by Government departments, local authorities or statutory undertakings, would be at the existing use value on March 1939 standard. This decision, in view of the change since then in the value of money, will be challenged on behalf of the landowners.

The powers already possessed by local authorities for dealing with devastated areas are extended to any land wanted for development or redevelopment for a 10-year building programme. Such programmes could be extended when plans are reviewed at least every five years, and could thus always be kept five to ten years ahead.

The Bill also provides powers to control outdoor advertisements which have long disfigured town and country. Authorities already have powers to preserve trees in the interests of amenity, and historic buildings, and these are reaffirmed at the same time as the Bill repeals previous planning legislation.

Land development or replanning, the provision of basic services and the erection or demolition of buildings require not only legislation to make them possible, but a labour force, a wealth of raw materials and financial reserves not yet available in sufficient strength and quantity. Nevertheless, essential preliminary measures have been and continue to be taken. Local planning committees have been formed, town planning schemes approved, sites for hundreds of thousands of future houses chosen, a vast programme of varied map production and revision undertaken, and expert advisory committees set to work. The main principles of the plan for decentralizing Greater London have been approved, and the creation of new satellite towns outside it provided for by Parliament. Hydro-electric generating works have been decided on for harnessing the waterpower of the Scottish Highlands. The Severn Barrage scheme for using the strong tidal streams as a source of electricity has been found practicable and economic. And other major regional schemes are contemplated.

MEETING OF COUNCIL

A meeting of the Council of the Institute was held at Headquarters on Saturday, February 15th, 1947, at nine thirty a.m.

Present: Vice-President J. E. Armstrong (Montreal) in the chair; Vice-President G. F. Layne (Quebec); Councillors P. E. Buss (Thorold), G. J. Currie (Halifax), J. R. Dunbar (Hamilton), E. Lavigne (Quebec), W. L. Saunders (Ottawa), J. A. Vance (Woodstock), W. S. Wilson (Toronto), R. S. Eadie, R. C. Flitton, C. C. Lindsay, C. A. Peachey, P. E. Poitras, J. B. Stirling, and Treasurer J. A. Lalonde, of Montreal; General Secretary L. Austin Wright and Assistant General Secretary Louis Trudel. There were also present by invitation—President-Designate Colonel L. F. Grant, of Kingston, and Mr. F. F. Dyer, chairman of the Sarnia Branch.

Annual Meeting 1947: The general secretary reported on the meeting which he and Mr. Trudel had had with the annual meeting committee of the Toronto Branch on January 22nd in Toronto. He concluded by presenting the draft of a programme which had been sent to Headquarters by the committee following the meeting.

The general secretary then presented a letter from the Committee on Community Planning which stated that due to the short period of time available on the annual meeting programme for community planning, the committee would prefer not to participate but in its place would like to have authorization to arrange another conference, either in Toronto or Ottawa, to be devoted exclusively to that subject.

A long discussion followed in which most councillors took part and during which many proposals were made. Mr. Eadie expressed the opinion that the technical sessions were by far the most popular part of an annual meeting programme. Mr. Dunbar and Mr. Lalonde agreed with this, and Mr. Dunbar recommended that Friday be devoted entirely to technical sessions so that persons attending for that purpose, if pressed for time, could leave Toronto Friday night rather than wait over until Saturday morning for further technical subjects. Council agreed generally with this recommendation and was unanimous in recommending to the Toronto committee that Air Commodore Whittle's paper be delivered on Friday, preferably in the afternoon, and that Friday morning be devoted to additional technical subjects. It was recommended also that Commodore Whittle be asked to be the luncheon speaker on the same day, taking as his subject the early history of his experiences in the turbo-jet field. This would be a non-technical paper which would have a very wide appeal to a mixed audience.

Council next considered the request of the Committee on Community Planning, and eventually agreed unanimously that there be no paper at this meeting on that subject, it being understood that this is in accordance with the wishes of the Toronto committee and the Committee on Community Planning. It was agreed also that the Committee on Community Planning be authorized to proceed with a special session under the auspices of the Council and within the control of the committee.

The chairman suggested that some members of Council should accompany the general secretary to Toronto to make these recommendations to the committee. Councillor Saunders stated that he would be in Toronto next week and it was agreed that he, Councillor Wilson from Toronto, and President-Designate Grant should endeavour to arrange a meeting with the Toronto committee at the earliest possible date.

Honorary Memberships: The general secretary presented a list of eleven names made up of recommendations from the various branches, for election to honorary membership. He pointed out that the by-laws restrict the total number of honorary members to twenty but that there were now four vacancies.

Different means were considered by which the Council could be canvassed and eventually it was agreed that, at this meeting, four of the eleven should be selected to go out by final letter ballot to all councillors. Accordingly, each councillor present was given a ballot with eleven names upon which he was requested to place in the order of his preference, a number opposite each name. Mr. Trudel was appointed scrutineer and, after an intermission, he reported the four names which were given the best support. The general secretary was instructed to send these names out immediately by ballot to all councillors, it being the intention to have the ballot returned in time to be opened at the next meeting of Council in Saint John on March 15th.

Canadian Council: Mr. Stirling, the chairman of the Committee on Professional Interests, reported on the reactions to the circular letter sent out by his committee dealing with the Canadian Council of Professional Engineers and Scientists. Several letters have been received encouraging the committee in its policy, but at the same time two communications had been received that offered criticism. One of these members has misunderstood the communication, and has thought it was the Dominion Council that was referred to. He recommended that the letters be left with the committee for further study and for report at the next meeting. This was approved unanimously.

Harry Bennett Educational Fund: Mr. Vance presented a progress report which brought Council up to date on the activities of the committee, and made recommendations with regard to the appointment of trustees. He pointed out that the campaign had been successful and that the objective had been almost reached, with additional contributions still coming in. He presented also the auditors' statement up tc the end of 1946, which report was accepted by Council.

Mr. Vance reviewed the development which had led to the securing of a trust deed and the setting up of trustees to control the funds. He explained that the three members of the committee, R. E. Heartz of Montreal, E. V. Buchanan of London and himself, had accepted the positions of trustees temporarily, in order to get the whole matter under way. He now recommended, with the approval of the other members of the committee, that the resignations of all three trustees be accepted, and that the following appointments be made in their place:

J. B. McPhail, Montreal, appointment to terminate at the end of 1949;

V. A. McKillop, London, Ont., appointment to terminate at the end of 1948;

E. V. Buchanan, London, Ont., appointment to terminate at the end of 1947.

Council regretted that Mr. Heartz and Mr. Vance found it necessary to retire. The work which they had done up to the present time was fully appreciated, and Council realized that they should be excused from further duties if they so desired.

Mr. Vance explained further that the committee would like to suggest, for the guidance of Council, that an effort be made at all times to select two trustees who would be located close together so that decisions could be reached quickly. It would be possible to obtain this result and yet rotate the trusteeship through a fairly wide area. The committee recommended also that an effort be made to always have on the Board of Trustees one who is a member of Council.

After considerable discussion, in which the chairman and councillors expressed further appreciation of the work done by the committee, the report was accepted unanimously, it being stipulated that the new trustees take office as of the date of this meeting.

Committee on Employment Conditions: The general secretary presented a copy of a letter which had been sent by the Committee on Employment Conditions to the Minister of Labour, which reads as follows:

February 10, 1947.

The Hon. Humphrey Mitchell,
Minister of Labour,
Parliament Buildings,
Ottawa, Ont.

Dear Mr. Mitchell:

Recently, the Institute's Committee on Employment Conditions has examined the draft of The Industrial Relations and Disputes Investigation Act, 1947. This appears to be a more workable piece of legislation than Order-in-Council 1003.

The committee's attention has been called particularly to the changes in the definition of an employee, and also to the inclusion of the word "profession" in Clause 10.

At the time Order-in-Council 1003 was being considered, the Institute made a complete canvass of its membership across Canada and the returned questionnaires gave many clear and decisive proofs of what the membership wanted. Bargaining by professional engineers for themselves was uniformly desired in 92% of the replies; and if this were not assured, 65% desired total exclusion from the provisions of the Order. Less than 1% desired trade unions as bargaining agencies.

As the largest organization of professional people in Canada we observe with great concern that Section 10 of the draft bill, due to rulings of the federal and provincial boards, could be used readily to compel professional engineers to accept representation in a draftsmen's or other trade union. We respectfully submit that there is no reason why compulsion of this sort should be applied to engineers against their wishes so clearly expressed. We therefore ask that the draft bill be amended to give professional engineers the clear right to do their own bargaining in all cases where they may so desire; and failing this, we ask that they be excluded equally clearly from the operation of the bill.

Yours sincerely,

(Signed) L. Austin Wright,
General Secretary.

The chairman pointed out that this was by way of a progress report and that in the letter the committee was endeavouring to carry out the mandate from the membership as indicated on the questionnaire. It was moved by Mr. Eadie and seconded by Mr. Vance and agreed unanimously that the action taken by the committee be approved.

American Institute of Mining and Metallurgical Engineers: The general secretary reported that Past-President Beaubien had been approached to represent the Institute at the seventy-fifth anniversary meeting of the American Institute of Mining and Metallurgical Engineers, and had agreed to act. Accordingly, on the motion of Mr. Dunbar, seconded by Mr. Poitras, it was unanimously resolved that Mr. Beaubien be appointed the official representative.

Financial Statement for the Year 1946: The financial statement for the year 1946 was presented by the chairman of the Finance Committee who, in addition to circulating the report, summarized the contents for discussion. He pointed out that the statement is more favourable than was the one for 1945 but noted that income and expenditures were both up. The increase in the former more than made up for the latter but the year finished up with a deficit of approximately $1700.00, whereas for 1945 it had been approximately $3500.00. After discussion, the statement was approved unanimously for submission to the annual meeting.

Headquarters Staff: The general secretary announced that Mr. Louis Trudel, the assistant general secretary, had presented his resignation to be effective April 1st. Mr. Trudel had received an attractive offer which the Institute could not meet. He explained that Mr. Trudel had been with the Institute for eight years during which time he had rendered exceedingly satisfactory service. He pointed out to Council the seriousness of this development, and suggested that each person make every endeavour to assist in finding a replacement. The chairman observed that this was a serious blow to the Institute, but he agreed that Mr. Trudel could not very well refuse the offer that had been made. He recommended that the Institute had no option but to release him, and certainly would wish him every success in his new field.

In reply Mr. Trudel thanked the chairman and Council for their kind remarks. He said that he had had a difficult time making the decision to sever his connection with the Institute. He had enjoyed his employment, and would still remain closely associated with the Institute. Upon a motion which was unanimously approved, Mr. Trudel's resignation was accepted.

Committee on Deterioration of Concrete Structures: A letter was presented from Mr. R. B. Young, assistant director of research of the Hydro Electric Power Commission of Ontario, who had been chairman for many years of the Institute's Committee on Deterioration of Concrete Structures, in which Mr. Young made inquiries as to Council's interest in the development of research in this field.

The letter reviewed the past work of the Committee and described the importance and the complications of carrying out further work. Mr. Young felt that there was a great deal of good work that could be accomplished provided Council was interested in proceeding with it.

He suggested that he might call together the former members of the committee and others for a meeting during the time of the annual meeting in Toronto, with the thought of preparing some recommendations for Council's consideration.

Council expressed appreciation of the importance of work of this kind, and also of the accomplishments of the committee in the past, and gave unanimous approval to Mr. Young's suggestion with regard to the meeting in Toronto.

Students' Conference: The general secretary reported that a circular letter had been sent to all the undergraduate engineering societies and to the deans of engineering, inquiring as to the next students' conference. So far replies have been received from only one university, and it supported the idea that the conference should be continued. This was noted.

Aid to Veterans: Colonel Grant stated that he was somewhat concerned about the future of the many veterans who are now enrolled in engineering courses in different parts of Canada. He was considering whether or not there was something which the Institute might do that would be of assistance to them. He stated that his actual contacts with these students had shown that they were a group of earnest, hard-working young men, and their spirit and performance was inspiring.

Colonel Wilson expressed his interest in the same problem, although like Colonel Grant he was not able to make any specific proposal at the moment as to what the Institute might do.

It was pointed out that through the employment department, the Institute had already rendered a service to the group, and that it would be increasingly important to them on graduation. Colonel Grant suggested that this might be a problem that could be taken up by the new Field Secretary.

A.S.M.E. Semi-Annual Meeting: Unanimous approval was given to the proposal that the Institute join with the American Society of Mechanical Engineers in developing a joint session at their summer meeting in Chicago on the subject of "Coal Handling with Earth Moving Equipment".

National Safety Week: In response to a suggestion from the Canadian Chamber of Commerce unanimous approval was given to the proposal that the Institute participate in a conference to consider the promotion of a National Safety Week.

A.I.E.E. Summer Meeting—Montreal: A letter was presented from the Montreal committee giving particulars of a boat trip up the Saguenay which had been arranged for the week-end of June 13th. The committee would be glad to arrange accommodation for any officers of the Institute who wished to participate in this trip. This was noted with appreciation.

Mr. Dyer asked the chairman's permission to express to Council the pleasure it had given him to be able to attend this meeting. He stated that he would take a lot of interesting information back to the Sarnia Branch. He reported that the Sarnia Branch, which in 1945 had only 15 members, now had a total of 64. He explained that in Sarnia there was a large body of engineers in miscellaneous occupations. He thought that the Engineering Institute, as the largest organization, might do a lot towards bringing the group together so that there would be close cooperation.

It was noted that the next meeting of Council would be held at the Admiral Beatty Hotel, Saint John, New Brunswick, on Saturday, March 15th, during the president's tour of the maritime branches.

The Council rose at five twenty p.m.

ELECTIONS AND TRANSFERS

A number of applications were presented for consideration, and on the recommendation of the Admissions Committee, the following elections and transfers were effected:

Members

Carruthers, Harvey, B.A.Sc., British Columbia, district mgr., Bingham Pump Co., Vancouver, B.C.

Code, Robert G., B.Sc., (Civil), Queen's civil engr. & Ontario Land Surveyor, London, Ont.

Fugler, Ronald William, B.A.Sc., (Chem. Engrg.), Toronto, mech. supvr., fabrication plant, Canadian Resins & Chemicals Ltd., Shawinigan Falls, Que.

Huda, A. F. M. Mirza Shamsul, B.Eng., (Civil), Univ. of Calcutta, graduate studies, Univ. of Toronto, Ont.

Johnston, David H., B.Sc., (Elect. Engrg.), Queen's asst. operator, seismograph field party, Imperial Oil Limited, Ottawa, Ont.

Little, Donald Cameron, B.Sc., (Mining), Saskatchewan, jr. engr., Kelsey Wheel Co. Ltd., Windsor, Ont.

Morton, Stanley, B.C. manager, Renold-Coventry Ltd., R&M Bearings Canada Ltd., Vancouver, B.C.

Motherwell, Robert King, B.Sc., (Mech. Engrg.), Queen's, student, Canadian General Electric, Peterborough, Ont.

Neilson, Maurice O., Civil Engr., Univ. of Stockholm, consultg. engr., Toronto, Ont.

Noyes, Richard Roe, B.A.Sc., (Mech. Engrg.), Toronto, asst. district mgr., Canadian Sirocco Co. Ltd., 630 Dorchester St., W., Montreal, Que.

Perkins, Charles Lee, B.Sc., (Elect. Engrg.), New Brunswick resident engr., Civil Aviation Br., Dept. of Transport, Toronto, Ont.

Walker, William Deans, B.Sc., (Mech.), Queen's, asst. supt. of machine shop, Ford Motor Co. of Canada, Windsor, Ont.

Juniors

Green, Kenneth Wilson, B.Sc., (Elect.), Manitoba, 408 Rosedale Ave., Winnipeg, Man.

Skene, Alexander Wilbert, B.A.Sc., British Columbia, sr. engr., Imperial Oil Limited, Calgary, Alta.

Affiliates

Phelps, Thomas Henry, vocational director, Collegiate and Vocational School, Cornwall, Ont.

Stanley, Ross Meredith, B.Sc., (Arch.), Alberta, designer, Meech, Mitchell & Meech, Lethbridge, Alta.

Transferred from the class of Junior to that of Member

Ackhurst, William Hall, B.Sc., (Elect.), N.S. Tech. College, industrial app. engr., Canadian General Electric, Toronto, Ont.

Bethel, Vincent Walter, Major, R.C.E.M.E., B.Sc., (Elect.), Toronto, Barriefield Military Camp, Kingston, Ont.

Holgate, David Crossley, B.Eng., (Civil), McGill, engr., Sault Structural Steel Co., Ltd., Sault Ste. Marie, Ont.

Hubbard, Frederick Wilmot, B.Sc., (Elect.), New Brunswick, elect. foreman, nylon divn., Canadian Industries Limited, Kingston, Ont.

Langley, John Gordon, B.Eng., (Elect.), McGill, sales engr., apparatus dept., Canadian General Electric Co., Ltd., Toronto, Ont.
Near, Frank Manning, B.A.Sc., Toronto, jr. engr., hydraulic dept., H.E.P.C. of Ontario, Toronto, Ont.
Rahilly, Thomas Francis, B.Sc., (Mech.), Queen's, asst. supt., mech. dept., Algoma Steel Corporation, Sault Ste. Marie, Ont.
Rattenbury, David James, B.A.Sc., (Mech.), British Columbia, chief dftsman., Canadian Sumner Iron Works, Vancouver, B.C.
Seifert, Harold Lorne B., B.Eng., (Chem.), McGill, tech. supt., Spruce Falls Power & Paper Co., Ltd., Kapuskasing, Ont.
Spencer, George Hylton, R.C.E. Graduate, R.M.C.; B.Sc., (Civil), Queen's, General Staff Officer, Royal Military College, Kingston, Ont.

Admitted as Students

Students at University of Toronto

J. A. Agnew	J. S. Flavelle	W. J. Mosley
E. B. Allen	I. I. Glass	D. B. Mutton
L. Bresolin	A. W. Hanson	R. H. O'Grady
A. A. Brooks	G. J. Harlock	R. G. S. Penwill
A. K. Bunnell	H. G. Harper	N. Prochnicki
F. L. Caldwell	H. L. Johnston	G. E. Reid
W. S. Chisholm	M. A. Kilpatrick	G. A. Robinson
W. B. H. Chong	J. G. LaVergne	S. L. Sachs
H. P. Connor	K. C. Livingston	H. J. Smuck
C. L. Crandall	R. H. Lockwood	M. F. Southcote
D. D. Dunbar	A. Main	F. M. Squires
E. W. Dunlap	D. C. Marshall	G. A. Steele
J. B. Elder	T. J. McCaffery	I. Sveinbjornson
T. Elidoros	J. H. McQuiston	A. G. Taylor
P. A. Fellowes	J. O. Miller	J. F. Trant
R. J. Fennell	D. W. Morash	D. L. Turner
		W. A. Warfe

Students at McGill University

G. R. Blair	B. D'Amour	C. F. O'Donnell
J. A. Buchanan	E. N. Jeffers	J. P. A. Poirier
G. M. Cairns	J. K. Meagher	D. W. Rigby
W. J. Campbell	H. S. Moody	G. Rothschild
J. Croteau	G. S. Morrison	G. L. Schneider
		L. A. Zalkind

Students at Laval University

A. Allaire	R. L. Fontaine	E. Laplante
L. Beaudoin	G. Gagnon	J. Lemay
C. E. Begin	J. C. Huot	G. Matte
J. J. Y. Belanger	J. J. C. L. Hurtubise	H. Renault
R. Bergeron	J. A. C. Labrecque	J. Roberge
R. Boisvert	J. Lacroix	M. L. Trepanier
J. A. G. Evoy	M. Laliberte	

Students at University of Manitoba

B. H. Anderson	D. R. McLeod	W. G. Plewes
L. A. Leeyus	R. D. G. McQuillan	H. B. Rosenberg
E. A. Moore	A. E. Mudge	H. L. Waisman

Students at University of New Brunswick

G. L. Atyeo	L. W. McCarthy	R. R. Scott
R. W. Crowley	A. F. McKenzie	G. H. Skovmand
L. J. Debly	L. G. MacQuarrie	K. W. Stairs
D. E. Henry	D. P. Mersereau	W. M. Smith
J. E. McAllister	R. S. Myles	R. F. Swim
		V. A. Taylor

Students at Queen's University

J. G. S. Billingsley	J. T. R. Brownridge	E. G. Hackborn

Students at Nova Scotia Technical College

G. H. Dunphy	L. L. Marshall

By virtue of the cooperative agreements between the Institute and the associations of professional engineers, the following elections and transfers have become effective:

ALBERTA

Members

Morris, Darcy Drummond, B.Sc., (Engrg.), Alberta, genl. supt., Alberta Nitrogen (dept. of Consolidated Mining & Smelting Co.), Calgary, Alta.
Redman, Donald Lee, B.Sc., (Mining Engrg.), Alberta, petroleum engr., California Standard Co. Calgary, Alta.

SASKATCHEWAN

Members

McKillop, Douglas Bruce, B.Sc., (Civil), Queen's, division engr., Canadian National Railways, Regina, Sask.

Junior to Member

Graham, Harry Marker, B.Sc., (Mech. Engrg.), Saskatchewan, lecturer, Univ. of Saskatchewan, Saskatoon, Sask.
Mantle, John Bertram, B.Sc., (Mech.), Sask., instructor, dept. of engineering, Univ. of Saskatchewan, Saskatoon, Sask.
McMorine, James Gordon Stalker, B.Sc., (Civil Engrg.), Saskatchewan, jr. hydraulic engr., Dept. of Agriculture, P.F.R.A., Regina, Sask.

NOVA SCOTIA

Members

Cohn, Albert Raymond, B.Eng., Nova Scotia Tech., appraiser, estimator, structl. damage, Dominion Government, Halifax, N.S.
Fleming, William Crawford, B.Eng., (Civil), Nova Scotia Tech., stripping supt., Canadian Gypsum Co. Ltd., Windsor, N.S.

QUEBEC

Members

Brault, Joseph Real, B.A.Sc., C.E., Ecole Poly., asst. sales mgr., Plessisville Foundry Co., Montreal, Que.
Chernovsky, Bernard, B.A.Sc., Toronto, consultg., engr., Kearns & Bromley, Montreal, Que.
Girard, Napoleon Raoul, B.A.Sc., C.E., Ecole Poly., bridge engr., Public Works Dept., Province of Quebec, Quebec.
Middleton, Brian McLaren, B.Sc., Toronto, field engr., Cuvier Mines Ltd., Montreal, Que.
Paquette, Joseph Leo, B.A.Sc., Toronto, consultg. & design engr., Atwood Limited, Montreal, Que.
Rutherford, Ronald Murray, B. Eng., (Elect.), McGill, elect. engr., water resources dept., Shawinigan Water & Power Co., Montreal, Que.

Junior to Member

Green, Michael Stephen, B.Eng., Nova Scotia Tech. College, asst. to sales development mgr., Dominion Bridge Co., Ltd., Montreal, Que.
Sylvester, Jack Douglas, B.Sc., (Elect.), Alberta, asst. engr., Canadian National Railways, Montreal, Que.
Vergin, Leonard John, B.Sc., (Elect. Engrg.), Manitoba, high tension transmission engr., Aluminum Laboratories Limited, Montreal, Que.

Student

Gravel, Jean Paul, designer & dftsman., McDougall & Friedman, Montreal, Que.

LARGE-SCALE HOUSING—ITS PLANNING AND CONSTRUCTION

(*Continued from page 116*)

When first bids were opened, however, they showed exactly a 60 per cent increase over 1940. We threw them out as beyond reason; that reason being the limits set by the economists. We decided to start foundations only, sitting out the market for a few months. When we re-bid the first job after a three months sitting period, the cost was 67 per cent over 1940, and the scales fell from our eyes. We knew then we were in a rising market, so we proceeded to get our work under contract as soon as possible. Costs kept going up, 75 per cent, 80 per cent, and more. We are now paying double what we used to, and costs are expected to go even higher before they start to recede. The economists are still showing by charts and cost indices that current costs are possibly 50 per cent to 60 per cent higher than 1940. But we refuse to even read their analyses any more, because the trouble with a cost index as usually prepared is that it is based on posted material prices, and on current wage scales. But the former may or may not be realistic, considering shortages and delays in deliveries, while the latter do not reflect productive effort on the job.

The acid test is in bidding and building, and with nearly $80,000,000 of construction contracts bid by us during 1946 alone, it does not need any economist to tell us what current costs are. They are already twice what they were in 1940. This is fact, not theory. With costs like these, the need for economy is even more pressing.

Personals

News of the Personal Activities of members of the Institute

E. K. Phillips, M.E.I.C., the new chairman of the Saskatchewan Branch of the Institute, was born in Ottawa, Ont. He attended schools in Saskatoon and Regina and entered the University of Saskatchewan, graduating in 1925 with a B.E. degree. He demonstrated in civil engineering at the University and obtained his M.Sc. degree in 1927. He was then appointed lecturer in the civil engineering department. For many years he was also connected with the firm of Phillips, Stewart and Phillips, land surveyors and municipal engineers of Saskatoon, practising during the summers and becoming a junior partner of the firm around 1930. He is still with the University, and practises as a consulting engineer.

Dr. W. W. Colpitts, M.E.I.C., consulting engineering of the firm of Coverdale and Colpitts, New York City, was appointed a Governor of McGill University, Montreal, in July, 1946. He is a McGill alumnus, with B.Sc., M.Sc. and LL.D. degrees received in 1899, 1901 and 1921. A Member of long standing of the Institute, he was awarded Life Membership in January this year.

Frederick Palmer, M.E.I.C., senior Canadian government trade commissioner in Stockholm, Sweden, was appointed chargé d'affaires on the recent opening of a Canadian legation in Stockholm. Mr. Palmer went to Stockholm early last year. He had previously carried out a special trade mission to China and has served as the Canadian Government Trade Commissioner in Holland, Italy, Norway, Denmark, Finland, Great Britain and Australia.

Ephrem Viens, M.E.I.C., director of the testing laboratories of the Department of Public Works, Ottawa, retired in January. He joined the staff of the Department of Public Works in 1907 as a chemist in the testing laboratories, two years after he graduated in arts from McMaster University, specializing in chemistry and physics. He served on the council of the Institute representing the Ottawa Branch in 1938-39.

Ira P. Macnab, M.E.I.C., of the Nova Scotia Board of Commissioners of Public Utilities has accepted the appointment of manager of the Halifax Public Service Commission. Mr. Macnab, who was for three years chairman of the Halifax City Planning Commission, has been on the provincial commission since 1935. Active in the Institute, he has served as chairman and councillor for the Halifax Branch.

Dr. R. Melville Smith, M.E.I.C., was presented with honorary life membership in the Ontario Good Roads Association at its annual meeting in February. Mr. Smith is president of the Canada Culvert Company Limited, Toronto, which position he accepted in 1945 after fifteen years service as Deputy Minister of Highways for Ontario.

W. A. McLean, M.E.I.C., consulting engineer of Pickering, Ont., received a life honorary membership in the Ontario Good Roads Association recently. After many years of service with the Ontario Government, he resigned as Deputy Minister of Highways in 1923, and in 1925 joined the firm of Wynne-Roberts, Son, and McLean, Toronto. He is a member of the Institution of Civil Engineers of Great Britain, and a past-president of the Canadian Good Roads Association and of the American Road Builders Association. He was a councillor of the Institute in 1919-1921.

Tullis N. Carter, M.E.I.C., vice-president and chief engineer of the Carter Construction Company Limited, Toronto, was elected president of the Ontario Road Builders' Association at the annual meeting in February.

W. F. Mainguy, M.E.I.C., has been appointed vice-president in charge of distribution for the Shawinigan Water and Power Company, Montreal. He has been with the company since 1928 when he was employed as a draughtsman with the company's engineering subsidiary, the Shawinigan Engineering Company Limited. In 1932 he was appointed power sales engineer of the commercial and distribution department of the Shawinigan Water and Power Company, becoming power sales manager of that department in 1937. In 1942 he was appointed personnel co-ordinator, and in 1943 personnel manager, which position he held until his new appointment. He is a graduate of Queen's University, Kingston, Ont., a member of the Corporation of Professional Engineers of Quebec, of the Canadian Electrical Association, and of the American Management Association. He is a past-chairman of the Montreal chapter of the Illuminating Engineering Society. He is on the Institute's Committee on Industrial Relations.

J. M. Breen, M.E.I.C., has been appointed assistant general manager of the Canada Cement Company Limited, Montreal. He is a graduate of the University of Toronto, class of 1921, and joined Canada Cement in Toronto in 1922 as a technical engineer. Transferred to Montreal in 1934, he was chief of technical staff for the company until his recent appointment.

E. B. Jost, M.E.I.C., who was general superintendent of canals, for the Department of Transport, Ottawa, has retired. He has been in government service for many years, joining the federal department of railways and canals in 1911, as resident engineer. He was later appointed divisional engineer and senior hydraulic engineer. He received his post with the Department of Transport in Ottawa in 1936.

C. W. West, M.E.I.C., who was superintending engineer of the Welland Ship Canal for the Department of Transport, succeeds Mr. Jost as director of canal services for the Department. He has been connected with the Welland Ship Canal since 1920, becoming superintending engineer in 1934.

S. R. Frost, M.E.I.C., has resumed his position with the North American Cyanamid Limited, Toronto, Ont. For the past three years he has been on loan to the Fertilizers Administration of the Wartime Prices and Trade Board, where he has been in charge of domestic production distribution, exports and imports of chemicals used in fertilizer production, and has been a member for Canada of the Committee on Fertilizers, International Emergency Food Council, Washington, D.C. Mr. Frost will be doing development engineering for his firm.

C. E. Frost, M.E.I.C., engineer (exchange) at the chief engineer's office, outside plant division, Bell Telephone Company of Canada, Montreal, has recently been transferred to the position of special studies engineer, Montreal division.

Lucien Buteau, M.E.I.C., engineer, Quebec district, Bell Telephone Company of Canada, has recently been transferred to the chief engineer's office, Montreal, as engineer (exchange), reporting to the exchange plant engineer, outside plant division.

W. Czerwinski, M.E.I.C., is now employed by A. V. Roe of Canada, Toronto, as senior stress analyst. He was formerly chief engineer of the Canadian Wooden Aircraft, Toronto.

T. Fife, M.E.I.C., is now in Halifax, N.S., as engineer manager of the H.M.C. Dockyard, after completing his sea time in the aircraft carrier *H.M.C.S. Warrior.*

J. M. Heaps, M.E.I.C., mechanical engineer with the Consolidated Mining and Smelting Company of Canada Limited at Trail, B.C., was awarded the Letson Memorial Prize for the best mechanical thesis presented to the Association of Professional Engineers of British Columbia in 1946. His thesis was entitled "Design of a Steam Edger Spotter" and describes an original design of a machine for use in sawmill operations.

F. C. Richardson, M.E.I.C., who was formerly with the Aluminum Company of Canada Limited at Shawinigan Falls, Que., has gone to Sarnia, Ont., where he is foundry superintendent for Mueller Limited.

A. L. MacDonald, M.E.I.C., was discharged from the army in December 1946, and has accepted employment in the sales department of Watson Jack and Company Limited, Montreal.

T. F. Kennedy, JR.E.I.C., has been appointed superintendent of Plant No. 2 in Amherst, N.S., for the Enamel and Heating Products Limited. A graduate of the University of New Brunswick with the degree of bachelor of science in engineering in 1941, he served with the R.C.A.F. until 1945, being discharged with the rank of squadron leader.

Bruce S. Taylor, JR.E.I.C., is now in Vancouver, B.C., as industrial engineer with the Industrial Development Bank.

John M. Dyke, JR.E.I.C., is with the Canadian Pacific Railway at Montreal in the capacity of mechanical engineer. He was formerly with the John Inglis Company Limited, Toronto, as boiler design engineer.

G. J. Dodd, JR.E.I.C., has been appointed manager of the prepared mix plant of the Russell-Miller Milling Company, Minneapolis, Minn. He was formerly assistant to the chief engineer of the company.

W. D. Johnston, JR.E.I.C., has gone to the Ideal Welding Company Limited, Toronto, as an engineer. He was formerly with the Dominion Bridge Company in that city.

H. D. Ralph, JR.E.I.C., is in Brantford, Ont., where he has been employed by the Cockshutt Plow Company Limited since his discharge from the Canadian Active Army in April last. He is assistant project engineer in the farm tractor division of the experimental department.

C. A. Stollery, JR.E.I.C., has recently become general manager of the Calgary Branch of the Poole Construction Company Limited. He was formerly building construction superintendent for the company.

L. E. Smith, JR.E.I.C., who was at Whitecourt, Alberta, with the Department of Transport, is now employed by the Alberta Department of Public Works, Highways Branch, as a resident highway engineer. He is located at Edmonton.

W. L. Hayhurst, S.E.I.C., a graduate of Queen's University, Kingston, in 1946, is at the California Institute of Technology, Pasadena, Calif., where he is doing post-graduate study.

A. R. Leger, S.E.I.C., was recently appointed to the position of sulphite mill engineer of the Anglo-Newfoundland Development Company Limited at Grand Falls, Newfoundland. A recent graduate in chemical engineering of Laval University, he joined the engineering staff of the Gaspesia Sulphite Company Limited at Chandler, Que., as a junior engineer last May.

Obituaries

The sympathy of the Institute is extended to the relatives of those whose passing is recorded here.

David O. Lewis, M.E.I.C., veteran railroadman and civil engineer, died in February, 1947, in Vancouver, B.C. He was born in Newtown, North Wales, in 1865. Coming to Canada, he was connected with railway engineering for many years. From 1882 to 1889 and from 1893 to 1903 he was with the Canadian Pacific Railway, working at many points on location and construction, as chainman, rodman, topographer, transitman, roadmaster, bridge and building master and resident engineer on maintenance. In the interval he was assistant engineer on land surveys for municipal and railway work for the State of Washington, U.S.A., and later had charge of land and townsite surveys for Gore, Burnet and Company, Victoria, B.C. From 1903 to 1921 he was connected with the Canadian National Railways. During these years his activities took him across Canada from Quebec to Northern B.C. In 1921 he went into private practice as a consulting engineer, when he was much in demand as an expert witness in court cases, coming east as adviser to the counsel for British Columbia in the freight rates enquiry of 1921. He was for a time connected with the Engineering Corporation, Limited, Vancouver, B.C., and in the last ten years he has been consulting engineer for the Pacific Great Eastern Railway in addition to many other calls.

Mr. Lewis, a Life Member of the Institute since March 1943, joined in 1894 as an Associate Member, transferring in 1907 to Member. He served on the Council in 1919-20, representing the Vancouver Branch.

Samuel J. Chapleau, M.E.I.C., former consulting engineer with the Department of Public Works of Canada, Ottawa, Ont., died on February 26th, 1947. He was born in Atlanta, Georgia, in 1869, and studied at the Rensselaer Polytechnic Institute, Troy, N.Y., from 1887 to 1891. He did some railway, municipal and hydrographic work in New York State, that year, and came to Montreal in 1892 as assistant division engineer on maintenance of way for Canadian Pacific Railway. Two years later he entered the Department of Public Works of Canada, and was first located in British Columbia on the hydrographic survey of the Fraser River. With the Railways and Canals Department he worked at Sault Ste. Marie, Ont., and as assistant engineer and structural draughtsman on the construction of the Soulanges Canal. Other work in the early years of his association with the Department of Public Works included hydrographic investigations of the St. Lawrence River channel above Brockville, improvements to harbours at Kingston, Gananoque, Brockville and Prescott, Ont., marine surveys above Montreal, and work on the Georgian Bay Ship Canal. Soon after 1900 he was stationed at Ottawa for the Department as resident engineer, and he remained with the board of engineers until his retirement eight years ago.

Mr. Chapleau joined the Institute as an Associate Member in 1896, becoming a Member in 1909. He served on the Council of the Institute from 1913 to 1915, and Life Membership was awarded to him in October, 1935. He was also a member of the American Society of Civil Engineers.

George Macleod, M.E.I.C., of New Westminster, B.C., died suddenly on January 5th, 1946. He was born in Scotland in 1886 and received his early education there. He served an apprenticeship as a pupil teacher and passed the King's Scholarship Examination in 1905. Coming to Canada in 1907 he was first employed by the Canadian Pacific Railway and he continued in railway work until the first World War. He enlisted as a Sapper in 1916 and served in France with the Canadian Railway Troops. Transferring to the 1st Canadian Bridging Company, he served in Egypt, Palestine and Syria, and returned to Canada in 1919. On his discharge, he worked as instrumentman on harbour improvement for the Vancouver Harbour Commission. In 1924 he joined the staff of the Provincial Public Works Department. He was located at Merritt, B.C., and at New Westminster, B.C., as general foreman, and was later assistant district engineer at Salmon Arm, B.C. In 1938 he was transferred to New Westminster as assistant district engineer, and he remained in that position until the time of his death.

Mr. Macleod joined the Institute as a Junior in 1912, transferring to Associate Member in 1940.

J. Arthur Jetté, M.E.I.C., former superintendent of the Montreal Aqueduct, died on February 19th, 1947. He was born in St. Paul of Joliette, Que., in 1883, and studied at Ecole Polytechnique, graduating in 1908 as a B.A.Sc. in civil engineering. He was employed first by the Trans-Continental Railway as instrumentman and in 1910 he worked as assistant engineer at St. Boniface, Man., on surveying for the Dominion Land Survey. He was assistant engineer for the city of Maisonneuve in 1912, and in 1913 assistant engineer for the city of Montreal, roads department. He transferred to the water works department in 1914 as assistant engineer and in 1920 went to the Montreal Water Board. He was made assistant superintending engineer of the canalization department of the city of Montreal in 1925, and later became superintending engineer.

Mr. Jetté joined the Institute in 1920 as an Associate Member, becoming a Member in 1925.

F. R. Reevely, M.E.I.C., of Mimico, Ont., passed away in August, 1945. He was production superintendent of the Power Tube Division of Rogers Radio Tubes Limited, Toronto. He was born at Bolton, Ont., in 1906 and studied arts at the University of Toronto, and mechanical drawing and allied subjects at Sir George Williams College, Montreal. He attended the shop student course of the Northern Electric Company in 1929, and was employed that year as an engineer in the technical development division of the company in Montreal. He remained with the company until 1942, concerned with electrical and chemical development problems, and then joined the chemical control office of the Department of Munitions and Supply in Montreal. He went to Rogers Radio Tubes Limited in 1944.

Mr. Reevely joined the Institute as a Junior in 1932, becoming an Associate Member in 1939 and a Member in 1940.

News of the Branches

Activities of the Twenty-eight Branches of the Institute and abstracts of papers presented

CALGARY BRANCH

J. F. Langston, m.e.i.c. - - - *Secretary-Treasurer*
D. C. Jones, jr.e.i.c. - - - - *Branch News Editor*

J. I. Strong, assistant city engineer, addressed the Calgary Branch on January 30th in the Palliser Hotel, on the subject of **Sewage Disposal**.

Mr. Strong stated that proper sewage disposal was important in industry and sanitation, and for the survival of fish and game life. Complete purification is the artificial adaptation of natural processes, the energy of countless bacteria, which is sustained by oxygen. In modern systems of sewage disposal, these natural processes are speeded up and intensified.

The treatment of sewage is divided into primary and secondary treatments. The first is concerned with the removal of solids by means of coarse and fine screens, grit chambers, settling tanks and digestors. The sewage passes through the grit tank where a reduction in velocity permits settling out of grit and silt. The coarse and fine screens then remove larger material, this material being raked off the screens and taken away for burning. The sewage then passes to a settling tank for a period of two to four hours, where further solids settle out and are scraped to the centre, from which point they are pumped to the digestor. The digestor contains heating coils which maintain a temperature of 85 to 90 deg. F. to speed up decomposition. The residue is then dried prior to being removed or burned.

The effluent from the settling tanks may be discharged into the river, or may be further processed in a secondary treatment. The basic process is that of oxidation of organic impurities in the sewage by bacterial action. This is accomplished by spraying the sewage on a filter bed of crushed rock. It is acted on by bacterial film covering the rock, which results in the formation of nitrates. Another form of this treatment is one using activated sludge, which results in a very clear effluent. However, with this latter treatment a very large volume of sludge must be handled.

Finally, the effluent goes to a settling tank before discharge, and in some cases chlorination of the effluent is employed.

Through the courtesy of the Canadian General Electric, a film "Clean Waters" was shown. This pictured the effects of pollution and outlined several typical treatment layouts.

At the conclusion of the film, J. McMillan thanked the speaker.

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J. M. Fleming, president of C. D. Howe Co. Ltd., consulting engineers, addressed this branch on the subject **Dust Control in Terminal Elevators** at a meeting held in the Palliser Hotel on February 13th.

The reduction of dust is important not only for the prevention of explosion but also since it may be injurious to the health of employees. Moreover, in some industries dust is collected because of its value.

Mr. Fleming stated that in the United States since 1900 there had been 177 grain dust explosions causing a property loss of $42,000,000. In that period there have been six in Canada, the most recent being in 1945. Since 1945 the Ontario Government has enacted safety regulations designed to reduce the hazard of grain dust explosions.

All grain dusts are combustible when properly mixed and the rate of propagation and the pressure developed are very high. Combustion is not spontaneous, it may be caused by hot bearings, tramp iron in elevators causing sparks, defective electrical equipment, and other similar sources of heat.

Elevators cannot be made strong enough to resist explosions, but venting areas can be provided to permit release of internal pressure. The grain bins should be covered and vented to outside air. A clean elevator is of prime importance in preventing secondary explosions, all floors, window ledges and machinery should be kept clean.

A dust control system reduces the amount of dust released to the air. Wherever dust is released, at conveyor loading and discharge points, elevator boots, etc., a hood is placed. Air and dust are pulled into the hoods by fans and carried in trunk lines to a cyclone. The dust is collected here and stored in a central bin before being shipped out.

The cost of a complete system is about $40,000 per million bushels of storage, with an installed capacity of 75 hp. per million bushels. From the point of view of reduced hazard and improved working conditions this cost is not excessive.

Mr. Fleming described the effect of the explosion at the Saskatchewan Wheat Pool terminal elevator. C. D. Howe Company Limited acted as consultants in the demolition of the remaining structure. Vertical sections of the concrete walls were made with a jack hammer, the reinforcing steel being cut with an acetylene torch. Dynamite charges were placed in the supporting concrete columns and the section was blasted out across the railway spur tracks; the rubble loaded on flat cars and dumped. A very interesting film of these operations was shown.

The chairman of the meeting, K. W. Mitchell, thanked the speaker for his interesting address.

EDMONTON BRANCH

W. W. Preston, jr.e.i.c. - *Secretary-Treasurer*

Professor R. M. Hardy, recently appointed dean of the Faculty of Applied Science of the University of Alberta, addressed a joint meeting of the Association of Professional Engineers of Alberta, the Edmonton Branch of The Engineering Institute of Canada and the Northern Alberta Branch of the Canadian Institute of Mining and Metallurgy, on February 7th, in the MacDonald Hotel.

He discussed aspects of **Engineering Education**, particularly conditions in our Canadian universities, resulting from greatly increased registrations of engineering students, and the employment problem facing the profession in the next two or three years.

Dean Hardy revealed that although other professions had restricted the number of students admitted to their faculties, engineering had admitted all people having the necessary qualifications. Seventy-five per cent of the students are veterans. By 1949 and 1950 there will be 3,000 to 4,000 graduate engineers to be absorbed into our economic life. The bright spot of this problem is that even though Canada has not absorbed engineers at the same rate as the United States, there are prospects that many new openings will be found during our industrial development.

Concerning the quality of the training which students are receiving today as compared with normal times, the speaker thought there was an improvement. The existing staff had to pay more attention to the organization of their courses and equipment, and the new junior staff were of a better grade as a result of instruction classes held for them.

In conclusion, Dean Hardy explained the trend in engineering education toward considering problems of human relationships. He pointed out that if the present curriculum is to be changed so that more time is spent on non-technical subjects, the technical subjects will suffer, but that the majority opinion opposes such a reduction. This means the curriculum must be lengthened, which in turn means that more money will be needed for education. Dean Hardy hoped that outside organizations would advocate the kind of training they consider desirable.

Chairman of the meeting, which was attended by 102, was L. C. Stevens, president of the A.P.E.A. The speaker was introduced by J. W. Porteous, chairman of the Edmonton Branch E.I.C., and the vote of thanks, which was heartily applauded, was proposed by R. M. Watson, secretary of the C.I.M.M.

LETHBRIDGE BRANCH

H. T. Miard, m.e.i.c. - - *Secretary-Treasurer*
E. A. Lawrence, s.e.i.c. - *Branch News Editor*

Members and guests of the Lethbridge Branch of the Institute entertained the ladies at a well attended dinner meeting in the Marquis Hotel, Saturday 15th February 1947.

Seated at the head table were Chairman and Mrs. R. S. Lawrence, Mr. and Mrs. W. Foss, Mr. and Mrs. C. S. Clendening, Mr. and Mrs. P. Kirkpatrick and Mr. A. L. H. Somerville.

George Brown's Instrumental Trio rendered selections during the dinner hour, and afterwards an outstanding musical programme was enjoyed by the assembled guests. Soloists included Miss Dawn Purkis and Miss Ella Findlay accompanied by Mrs. George Brown, and Mr. Arthur Hunt accompanied by Miss Ella Findlay. Guest violinist was Mr. Frank Hosek, accompanied by Miss Beatrice Livingstone. Community singing was led by E. A. Lawrence.

The chairman thanked the artists for their fine performance. The guests then viewed a film showing Toscanini directing the Westminster Choir, a cartoon on the history of electricity, and a travelogue on Mexico.

KINGSTON BRANCH

J. E. Thom, M.E.I.C. - *Secretary-Treasurer*

The January meeting of the Kingston Branch was held January 14th in the Hotel LaSalle, when Professor J. T. Wilson of Toronto spoke on **Exercise Musk-ox and the Canadian Arctic.** Prof. Wilson's enthusiasm for the Canadian North and the excellent films of the Musk-ox Operation provided a most interesting meeting.

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On February 5th the Branch met at Club 83 to hear J. I. McAskill, ceramist, Frontenac Floor and Wall Tile Company, Kingston, discuss **The Manufacture of Floor and Wall Tile.**

The Frontenac Floor and Wall Tile Company is the only organization in Canada producing such tile. Using local and imported clays, the company turns out tile in a wide range of colours and shapes and in addition produces pottery, tableware and a number of specialties. Mr. McAskill provided a brief background of the industry and then discussed the process now being used, illustrating his talk with samples of the raw materials and the product at each stage in its manufacture. D. Helsby, pottery foreman, assisted the speaker and gave a demonstration of moulding pottery products.

PETERBOROUGH BRANCH

A. R. Hailey, M.E.I.C. - *Secretary-Treasurer*
J. C. Allan, M.E.I.C. - *Branch News Editor*

A. E. H. Fair, president of the Alliance Paper Corporation spoke on **The Paper Industry in Canada** at a meeting of the Peterborough branch on February 6th. The general and historical features of the subject were very lucidly covered by a coloured motion picture made available through the courtesy of the Kenwood Company.

Mr. Fair described various aspects of the several methods of paper making, and the raw materials balsam, jack pine, hemlock, poplar, beech, birch and maple. Most of the standard papers in both high and low grades are made from these woods, but special papers may require cotton and linen rags, flax fibre, manila hemp, jute, and even straw. Methods of producing fine and specialty papers were described more fully and samples were distributed.

Almost all of the vanilla consumed in Canada and a large proportion of the British Empire is being made at Cornwall, Ont., from waste sulphite liquor.

Mr. Fair stated that the most evident influence in the paper industry today is that of technical progress. Mechanical logging is coming into its own and more attention is being paid to the procurement of uniform wood supplies. Improved mechanical barkers have been devised. Continuous fibre treatments have been developed to eliminate the human element in the setting of beaters and refining jordans.

Mr. Fair concluded with a summary of factors upon which the future of the paper industry depends.

A broad forest policy should be guided sanely by our government and carried out with sincerity by our operating companies. This involves the equitable distribution of the available wood, selective cutting to permit re-growth of the desirable species, and reforestation. Adequate protection of the forests from pests and fire is also necessary. Closer co-operation between lumber and pulp wood operators is possible. Joint operations are desirable whereby pulpwood and sawn timber are produced together, by allocating according to size and species. In addition to this, it is being proven now, that by removing bark from the larger logs prior to sawing, the slabs, which were burnt in the past, can be used for pulpwood. The settler, too, should be educated to improve his cutting practices and save the forests. This may be summarized by saying that we must look upon our forests not as a mineral but as a crop.

The second factor in the security of the industry is a sound labour policy, involving a continuing understanding between labour and management. The old policy of suspicion and collective bullying must go. Confidence and co-operation must prevail. Finally, the industry needs an increase in the number of engineers and technicians. These men must take time to learn the industry, which must have a training programme for technical men so that some assurance of their future position and responsibility will be available.

SAGUENAY BRANCH

Junior Section

T. T. Anderson, Jr.E.I.C. - *Secretary-Treasurer.*

An informal smoker meeting was held at the Saguenay Inn, Wednesday evening February 12th.

J. T. Madill introduced the speaker of the evening, Peter Simonds, presently of Aluminum Laboratories Limited, and formerly a captain overseas with the Royal Canadian Signals. His topic was **The Campaigns in North Western Europe.**

Illustrating his lecture with numerous personal snapshots as well as some official Canadian and enemy photographs, the speaker plunged into a thrilling authentic account of action from the Normandy beachhead right into Germany. Although primarily concerned with the campaigns, the talk touched also on line and wireless communications and other aspects of army signals.

He used line cut diagrams from his recent book, "Maple Leaf Up—Maple Leaf Down", to illustrate the Normandy landing and the closing of the Falaise "pocket" by part of General Patton's 3rd U.S. Army driving up from the Alencon and Argentan areas to join up with the Canadian wedge driving down from the north to take Falaise, key German communications centre. The speaker's brother, Lieut.-General Guy Granville Simonds, commanded the Canadian Corps which carried out this drive; the same corps having previously liberated Caen. The speaker explained how, although the 3rd U.S. Army and Canadian Corps were the "punch lines" in this fray, the 2nd British and first U.S. armies also played important roles in squeezing and containing the pocket. This is the battle which General Eisenhower in his official report has called the decisive one of the war. Although the speaker did not mention it, the line-cuts from his book were accurately reduced tracings from army quarter-inch battle maps used at the time and not the rather approximate maps which have often appeared on the subject.

The speaker went on to discuss the Battle of the Schelde which led to the opening of the great seaport of Antwerp to the allies the solving of their difficult supply problem at a time when it threatened the success of allied operations in the west, and an early ending of the war. This battle, which lasted a month from October to November 1944 was the biggest in which the first Canadian Army became engaged during the war. Mr. Simonds touched on the final drive into Germany with a series of small anecdotes and snapshots of damaged German towns and installations, including the Krupp Works at Essen, and pictures in the Hochwald and Reichwald forests of Germany where some of the bitterest fighting in the west took place.

At the close of the talk a hearty vote of thanks was moved by Graham Campbell and the meeting adjourned.

VICTORIA BRANCH

S. H. Frame, M.E.I.C. - *Secretary-Treasurer*
W. A. Ker, Jr.E.I.C. - - *Branch News Editor*

A general meeting of the Victoria Branch was held on Wednesday, January 29th in the Victoria Y.M.C.A. Building, with over 60 members and guests in attendance. Maj. R. C. Farrow, chairman of the branch introduced the speaker for the evening, Andrew G. Graham, supervisor of the Provincial Regional Planning Division, whose subject was **Regional Planning.**

Mr. Graham traced the development of organized town planning and pointed out that the first zoning by-law in Canada was passed in 1922 by the municipality of Point Grey. As a result of this legislation the conditions today in that area have fully justified the wisdom and foresight of the members of the municipal council of that date.

The speaker stressed the importance of regional planning as distinct from town planning, pointing out that "regional planning does not recognize local boundaries, and when the boundaries are outlined for a regional plan the area may cover a very wide or a small area".

He described the work done by the Provincial Regional Planning Division in British Columbia in which reports are made of each of the ten regions into which the province is divided, showing, in great detail, the physical assets, public services, amount of trade and industry, tourist attractions, and, in general, all factual data to indicate in what manner economic development of the Region could be recommended. In addition, advice is given as a free Government service to small incorporated cities and villages. In 1946 the Town Planning Act Amendment Act was passed giving the Provincial Government power to declare any area in unorganized territory a "regulated area" and to apply to that area such restrictions as are considered necessary for its proper regulation and development.

The speaker then outlined the work done in Regional Planning by some of the regions comprising the larger cities of Canada, including Montreal, Toronto, Ottawa and Winnipeg, pointing out that in each case surrounding areas were included in the "master plan".

Mr. Graham concluded his address by bringing forth the thought that was obviously foremost in his mind—"Why not a Greater Victoria Plan?"—and outlined for his audience the necessary steps to be taken.

A number of questions were asked of the speaker and a general discussion followed. Maj. R. G. Farrow thanked the speaker for his interesting and timely talk.

In addition to the members, guests included members of the Victoria and Oak Bay Town Planning Commission, members of the Municipal Councils and representatives of the local Architects and Land Surveyors.

WINNIPEG BRANCH

D. Hunter, M.E.I.C. - *Secretary-Treasurer*

Electrical Section

L. A. Bateman - *Secretary*
D. C. Brydon - - *News Editor*

The regular December meeting of the Electrical Section was held on December 5th. In view of the interest in electronics throughout the section, this meeting was arranged as an open forum on **Electronic Applications**. Professor E. R. Love directed the meeting and J. D. Peart and V. C. Jones discussed briefly the development of telephony and the use of carrier in the transmission of messages. Mr. E. W. Wirtanen outlined the amplidyne principle and discussed a few of its applications. A Canadian Westinghouse Company film entitled "Electronics at Work" was also shown. At the conclusion of the three short addresses, the meeting was thrown open for general discussion of electronic applications.

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Later in December, the section was fortunate in hearing J. T. Thwaites, division engineer, Electronics, of the Canadian Westinghouse Company. Mr. Thwaites covered a wide range of electronic applications. The applications with which he was directly connected during the war, such as radar, defense against V-2 rockets, equipment for jamming German radio communication, proved of exceptional interest to the members.

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The January meeting was held on January 9 in conjunction with the Winnipeg Branch meeting. The section nominating committee presented its report for officers for the ensuing year. The speaker for the evening was L. M. Hovey of the Winnipeg Electric Company, who spoke on **Installation of Distance Relays on the Transmission System of the Winnipeg Electric Company**. The paper was very ably presented and was illustrated with slides and a working model of a transmission line on which faults could be simulated and cleared by a HZ-211 distance relay.

Library Notes

Book notes, Additions to the Library of The Engineering Institute, Reviews of New Books and Publications

BOOK REVIEW

LAYING OUT FOR BOILER MAKERS AND PLATE FABRICATORS

Revised by George M. Davies. New York, Simmons-Boardman, 5th edition, c1944. 522 pp., illus., 11¼ x 8¾ in., cloth, $8.00.

Reviewed by John T. Farmer, M.E.I.C.*

This work deals with the technique of a very specialized subject, that of laying out the material for the various structures fabricated in metal plate, such as tanks, pipes, boilers, flues and stacks: and miscellaneous plate work. It concentrates particularly on boilers of standardized construction such as cylindrical and locomotive types. The present day land boiler, largely of tubular construction, is rather outside the scope of this work.

The present edition is the outcome of a series of issues dating back some forty years. In this period there have been many changes in design and developments in methods of construction; but basic principles have remained unaltered. In the course of the earlier half dozen editions, the opportunity has been taken to introduce new matter in keeping with the progress of the art. Furthermore, as time has passed certain earlier types and features have become obsolescent and consequently have been eliminated as no longer of practical interest.

The author, in introducing his subject, does not disdain to begin with the elementary principles; and the whole treatment of the subject is devoid of any recourse to advanced mathematics. Thus the work should be instructive and useful to any intelligent craftsman, as well as to those who have had the advantage of a more elaborate technical education.

The problems dealt with are illustrated profusely with some 750 excellent diagrams and illustrations; and the descriptive text accompanying them is notable for its clarity and completeness. Attention is given not only to the theory underlying the various problems, but also to the practical considerations which arise in the course of the actual working of the material involved.

One rather recent innovation is the extensive use of welding in platework, and in this edition a chapter has been devoted to this development.

The discussion of light sheet construction is not attempted in the present work, as there are many sources of information on that subject. Without going beyond the field of heavy plate construction, the matter dealt with extends to over 500 large pages. The reasonably large and very clear type used is to be commended.

**Mechanical Engineer, Montreal Engineering Company Limited.*

ADDITIONS TO THE LIBRARY

BOOKS, ETC.

Book of A.S.T.M. Methods of Chemical Analysis of Metals, 1946:
Philadelphia, American Society for Testing Materials, 1946. 402 p., illus., cloth.

Concise Chemical and Technical Dictionary:
H. Bennett, ed. Brooklyn, N.Y., Chemical Publishing Co., Toronto General Publishing Co., 1947. 1055 p., cloth.

Cosmic Radiation; Fifteen Lectures:
W. Heisenberg, ed., Translated by R. H. Johnson. N.Y., Dover Publications, 1946. 192 p., illus., cloth.

Designing with Magnesium:
American Magnesium Corporation, Subsidiary of Aluminum Co. of America, 1945. 323 p., illus., cardboard.

Electrical Engineering; 2d ed:
E. E. Kimberly. Scranton, Pa., International Textbook Company; Montreal, International Correspondence Schools, Canadian Ltd., 1946. 407 p., illus., cloth.

Fundamentals of Industrial Electronic Circuits:
Walther Richter. N.Y., McGraw Hill; Toronto, Embassy, 1947. 569 p., illus., cloth.

Improving London's Transport; a Publication of the Railway Gazette describing the New Works Scheme of the L.P.T.B., the L.N.E.R. and the G.W.R.:
London, Railway Gazette Publication, 1946. 108 p., illus., paper.

Industrial Carbon; Its Elemental, Adsorptive, and Manufactured Forms; 2d ed:
C. L. Mantell. N.Y., Van Nostrand, 1946. 472 p., illus., cloth.

Management and Morale:
F. J. Roethlisberger. Cambridge, Mass., Harvard University Press; Toronto, S. J. Reginald Saunders, 1946. 194 p., cloth.

Matrix and Tensor Calculus; with Applications to Mechanics, Elasticity, and Aeronautics:
Aristotle D. Michal. N.Y., Wiley, c1947. 132 p., illus., cloth.

Metallurgy of Quality Steels:
Charles M. Parker. N.Y., Reinhold, 1946. 248 p., illus., cloth.

Panel Heating and Cooling Analysis:
B. F. Raber and F. W. Hutchinson. N.Y., Wiley, c1947. 208 p., illus., cloth.

Reference Data for Radio Engineers; 2d ed:
Federal Telephone and Radio Corporation. N.Y., Federal Telephone and Radio Corporation; Montreal, Federal Electric Manufacturing Co., c1946. 322 p., illus., cloth.

Resistance of Materials; 3rd ed:
Fred B. Seely. N.Y., Wiley, c1947. 486 p., illus., cloth.

Roadway and Track:
Walter F. Rench. N.Y., Simmons-Boardman, c1946. 350 p., illus., cloth.

Romance of the Canadian Pacific Railway:
R. G. MacBeth. Toronto, Ryerson Press, c1924. 263 p., paper.

Surveying; Theory and Practice:
John Clayton Tracy. N.Y., Wiley, c1947. 1279 p., illus., cloth.

Wave Propagation in Periodic Structures; Electric Filters and Crystal Lattices:
Leon Brillouin. N.Y., McGraw-Hill; Toronto, Embassy, 1946. 247 p., illus., cloth.

What is Industrial Engineering?
J. D. Woods & Gordon Ltd., Toronto, Woods & Gordon, (1947). 74 p., paper.

PROCEEDINGS, TRANSACTIONS, ETC.

Highway Research Board:
Proceedings of the Twenty-Fifth Annual Meeting, 1946. Wash., National Research Council, 1946.

Institution of Water Engineers:
Transactions, Vol 51, 1946.
...Transactions, Summary of Contents and Subject Index to Volumes 1 to 51, 1896—1946.

National Council of State Boards of Engineering Examiners:
Proceedings of the Twenty-Fifth Annual Meeting, 1946.

Smithsonian Institution:
Annual Report of the Board of Regents, 1945. Wash., G.P.O., 1946.

Society for Experimental Stress Analysis:
Proceedings, Vol. 4, n. 1, 1946. Cambridge, Mass., Addison-Wesley Press, 1946.

TECHNICAL BULLETINS, REPORTS, ETC.

American Society for Testing Materials:
Symposium on Adhesives; Sponsored by Committee D-14, 1945.
...Theoretical Basis of Adhesion, W. A. Weyl. (Reprinted from A.S.T.M. Proceedings, vol. 46, 1945).

Canada. Senate. Standing Committee on Natural Resources on the Economic Value of Metalliferous Mines in Canada:
No. 1, May 1946. Ottawa, King's Printer, 1946.

Canada. Dept. of Public Works:
Annual Report, 1946.

Chalmers Tekniska Hogskolas. (Chalmers University of Technology):
Handlingar:—*Nr 53, 1946—Chalmers Solar Eclipse Ionospheric Expedition, 1945 with Experimental. Results and Theoretical Investigations of the Eclipse Effects, Olof E. H. Rydbeck.*

Electrochemical Society. Preprints:
91-1—Formation and Application of Phosphate Coatings, Van M. Darsey and Walter R. Cavanagh; 91-2—Discharge Characteristics of the Perchloric Acid Cell, J. C. White, W. H. Power, and others; Electrolytic Fluorine Production in Germany, Hans Neumark; 91-4—Electrolytic Cobalt; A Commercially Feasibel Process, F. K. Shelton, R. E. Churchward, and others.

Institution of Mechanical Engineers. Advance Papers:
Aeroplane Undercarriage, H. G. Conway; Development of Ultra High-Pressure Hydraulic Systems, S. M. Parker; Aircraft Wheel Brakes, D. A. L. Robson.
...Development of an Axial Flow Gas Turbine for Jet Propulsion, D. M. Smith; Practical Aspects of Cascade Wing Tunnel Research, K. W. Todd.
...Development of Locomotive Power at Speed, E. L. Diamond.
...Life of Carbide-Tipped Turning Tools, F. F. P. Bisacre and G. H. Bisacre.
...Recent Developments in Flying Boats, Henry Knowler. (Nineteenth Thomas Lowe Gray Lecture).

National Research Council. Information for the Press. Release:
No. 3—Associate Committee on Geodesy and Geophysics.

North-East Coast Institution of Engineers and Shipbuilders. Advance Papers:
Application of Modern Management Methods to the Shipbuilding Industry, F. A. J. Hodges; Marine Gas Turbine, Ad. Meyer.

N. V. Philips' Gloeilampenfabricken, Laboratoria (Holland). Separaat:
1511—On the Effective Length of a Small Barkhausen Discontinuity, J. L. Snoek; 1515—Potential Curve of the Alkali Halide Molecules, E. J. W. Verwey and J. H. De Boer; 1516—Atomic Distances in Small Graphite Crystals and the Nature of the Bond, J. H. De Boer; 1518—Residue and the Mechanism of Hearing, J. F. Schouten; 1530—Fluctuations and Electron Inertia, C. J. Bakker; 1533—Physical Properties of Glasses I, J. M. Stevels; 1534—Adsorption Phenomena on Massive Metal Surfaces Measured by Means of Electrical Resistances, J. J. Went; 1535—On Some Properties of Electrical Networks, W. Nijenhuis and F. L. Stumpers; 1539—Determining Factors of Permeability, J. L. Snoek.

Purdue University. Engineering Experiment Station. Research Series:
No. 97—Heat Transfer from a Vertical Plate to an Air Stream, L. Slefel and G. A. Hawkins, Discussion by Max Jakob.

STANDARDS, SPECIFICATIONS, ETC.

A.S.T.M. Standards on Glass and Glass Products:
A.S.T.M. Committee C-14, 1946.

British Standards Institution:
Codes of Practice Committee:—*CP(B)625 — Electrical Installations (general); CP(B)627—Choice, Installation & Maintenance of Electric Wiring Systems (for Power, Lighting or Heating Circuits) in Buildings.*
...Standards:— *BS 1340-43: 1946—Drawing Papers (Tracing, Detail and Cartridge).*

U.S. National Bureau of Standards. Building Materials and Structures:
Report BMS107 (superseding BMS88)—Building Code Requirements for New Dwelling Construction.

PAMPHLETS

Bulwarks of Freedom:
H. W. Prentis, Jr. Newcomen Society.

Canadian Research on Magnesium Alloys:
J. W. Meier. (Reprinted from Canadian Metals and Metallurgical Industries, October, 1946).

Mica in Modern Engineering:
Hugh P. Vowles. Ottawa, United Kingdom Information Office, 1947.

Surface Finish—Part 1 to Part 6:
F. C. Johansen. Ottawa, United Kingdom Information Office, 1947.

Zonolite; Concrete Structural Roofs; Concrete Roof Insulation:
Montreal, Webster and Sons Ltd.

BOOK NOTES

The Institute does not assume responsibility for any statements made; these are taken from the preface or the text of the book.

The following notes on new books appear here through the courtesy of the Engineering Societies Library of New York, and may be consulted at the Institute Library.

A.S.T.M. METHODS of CHEMICAL ANALYSIS of METALS, 1946:
American Society for Testing Materials, 1916 Race St., Philadelphia 3, Pa. 402 pp., diagrs., tables, 9¼ x 6 in., cloth, $4.50; to A.S.T.M. members, $3.00.

This revised and expanded volume gives in their latest approved form all of the methods issued by the American Society for Testing Materials covering the chemical analysis of the major ferrous and non-ferrous metals and alloys. In addition to methods for specific materials, recommended practices are given for apparatus,
(Continued on page 144)

PRELIMINARY NOTICE

of Applications for Admission and for Transfer

March 10th, 1947

The By-laws provide that the Council of the Institute shall approve, classify and elect candidates to membership and transfer from one grade of membership to a higher.

It is also provided that there shall be issued to all corporate members a list of the new applicants for admission and for transfer, containing a concise statement of the record of each applicant and the names of his references.

In order that the Council may determine justly the eligibility of each candidate, every member is asked to read carefully the list submitted herewith and to report promptly to the Secretary any facts which may affect the classification and selection of any of the candidates. In cases where the professional career of an applicant is known to any member, such member is specially invited to make a definite recommendation as to the proper classification of the candidate.*

If to your knowledge facts exist which are derogatory to the personal reputation of any applicant, they should be promptly communicated.

Communications relating to applicants are considered by the Council as strictly confidential.

The Council will consider the applications herein described at the April meeting.

L. Austin Wright, General Secretary

*The professional requirements are as follows:—

A **Member** shall have been engaged in some branch of engineering for at least six years, which period may include apprenticeship or pupilage in a qualified engineer's office or a term of instruction in a school of engineering recognized by the council. In every case a candidate for election shall have held a position of professionl responsibility for at least two years. The occupancy of a chair as professor, assistant professor, associate professor or lecturer in a faculty of applied science or engineering, shall be considered as professional responsibility.
Every candidate who has not graduated from a school of engineering recognized by the council shall be required to pass an examination as prescribed by council, on the theory and practice of engineering, with special reference to the branch of engineering in which he has been engaged.

A **Junior** shall have been engaged in some branch of engineering for at least four years. This period may be reduced to one year, if the candidate for election has graduated from a school of engineering recognized by the council, in which case he shall not remain in the class of Junior beyond the end of the eighth year after graduation.

Every candidate who has not passed the examinations of the third year in a school of engineering recognized by council shall be required to pass an examination in engineering science as prescribed by council. He shall not remain in the class of Junior beyond age thirty.

A Junior may be transferred to Member without payment of transfer fee providing he makes application before the end of the seventh year after graduation or, if a non-graduate, before attaining age twenty-nine, and his application is approved by council.

Council may extend the above limits if in its opinion special circumstances warrant such extension.

A **Student** shall be at least seventeen years of age, and shall present a certificate of having passed an examination equivalent to the final examination of a high school, or the matriculation of an arts or science course in a school of engineering recognized by the council or shall be required to write examinations as prescribed by the council.
He shall be:

a. pursuing a course of instruction in a school of engineering recognized by the council, in which case he shall be transferred to Junior automatically without payment of transfer fee in the second January after graduation, or

b. receiving a practical training in the profession in which case he shall be transferred to Junior without payment of transfer fee providing he makes application before attaining age twenty-five and his application is approved by council.

He shall not remain in the class of Student after he has attained the age of twenty-five, unless in the opinion of council special circumstances warrant the extension of this age limit.

An **Affiliate** shall be one who is not an engineer by profession but whose pursuits, scientific attainments or practlal experience qualify him to co-operate with engineers in the advancement of professional knowledge.

The fact that candidates give the names of certain members as reference does not necessarily mean that their applications are endorsed by such members.

FOR ADMISSION

BOTHAM—JOHN CHARLES, of Sydney, N.S. Born at Ottawa, Ont. May 12, 1920. Educ.: B.Sc. (Metall. Engrg.), Queen's, 1946; 1939, (summer), H. B. O'Connel Constrn. Co., Cadillac, Que.; 1941-42, (summers), forest prod. lab., Dept. Mines, Ottawa; 1943-44-45, (summers), chemistry div., Dept. Agriculture, Ottawa; physical metall. research lab.; 1946, (3 mos.), sr. mill operator, Canada China Clay & Silica, Kasil, Que.; at present, jr. engr., research dept., Dominion Steel & Coal Corp., Sydney, N.S.

References: S. G. Naish, W. L. Stuewe, J. A. MacDonald, J. H. Fraser, C. M. Anson.

BROWN—GORDON LEROY, 52 The Drive, Sault Ste Marie, Ont. Born at Sault Ste. Marie, Ont., Oct. 6, 1921. Educ.: B.A.Sc. (Civil), Toronto, 1945; R.PE., Ontario; 1940-44, (summers), asst. field engr., field engr., i/c levels and layout at Algoma Steel Corp., cost account., costs-Michipicotten Harbour, supt. constrn. of incinerator at Sault Ste. Marie, L. R. Brown & Co., Ltd., Sault Ste. Marie, Ont.; 1945, (6 mos.), R.C.E.; 1945 to date, field engr., quantities and field work at Marathon, cost accountg. and supt. work at Sault Ste. Marie, some steel design on welded bldgs., L. R. Brown & Co. Ltd., Sault Ste. Marie, Ont.

References: C. Stenbol, W. D. Adams, A. H. Russell, A. M. Wilson, J. L. Lang, K. G. Ross, L. R. Brown.

CARR—GORDON LANGTON, of Seven Sisters Falls, Man. Born at Russell, Man., July 8, 1899. Educ.: Electr. Engrg., I.C.S., Scranton, Pa., 1921-23; with Winnipeg Electric Co., as follows: 1919-20, appren., meter dept.; 1920-21 appren., hydro gen. stn.; 1921-23, appren., mtce and constrn. dept.; 1923-28, journeyman, mtce. and constrn.; 1928-30, chief elect., Carter, Halls, Aldinger Co. (on loan from Winnipeg Electric Co.); 1930-35, chief elect. 1935-44, gen. foreman, hydro stn.; 1944-47, asst. supt., Seven Sisters plant, Seven Sisters Falls, Man.

References: E. V. Caton, L. M. Hovey, A. S. Williams, C. P. Haltalin, V. W. Dick, A. L. Oddleifsson.

CLARK—STUART, of Port Arthur, Ont. Born at Toronto, Ont., Feb. 27, 1921. Educ.: B.Sc. (Mech. Eng.), Queen's, 1944; R. P. E., Ontario; (summer employment while at Univ.), 5 mos. appren. machinist, Kelsey Wheel Co., Windsor, Ont.; 9 mos., plant engrg. dftsman., Chrysler Corp. of Canada; 1944-46, Lieut. (E), i/c machinery aboard Bangor Minesweeper, R.C.N.; 1946-47, estimator, plate shop and time study in special products divn., John Inglis Co., Toronto; at present, process engr., lab., Thunder Bay Paper Co., Port Arthur, Ont.

References: D. S. Ellis, A. Jackson, J. D. Lee, G. H. Burbidge. T. C. Anderson.

COTE—ALBERT PETER, Capt., R.C.S., of Kingston, Ont. Born at Montreal, Que., Nov. 19, 1917. Educ.: B.Sc. (Chem. Eng.), Queen's, 1942; R.P.E., Ontario; 1939-40, (summers), dftsman., Cooksville Co., Ltd.; 1941, (summer), dftsman., International Nickel Co.; 1942-47, Captain, Royal Canadian Corps Signals, Vimy Barracks, Kingston, Ont.

References: K. H. McKibbin, J. E Genet, A. O. Monk, D. M. Jemmett, J. E. Thom

CURTIS—MAURICE LEONARD, 32 Ford Boulevard, Windsor, Ont Born at Taunton, Somerset, Eng., Feb. 2, 1903. Educ.: Huish Tech. Coll., Taunton, Eng., 1919-21, London Matric. & Interim B.Sc., 1921; M. Inst. M.E., London; Assoc., Inst. E. E., London; 1922-26, apprent., Frederick Bateman & Co., London, scientific instrument mfrs.; 1927-30, tech. asst., Lawrence & Mayo & Co., Ltd., London, scient. instrument mfrs. 1930-32, prod. engrg., Ford Motor Co. of England; 1932-35, asst. mgr., Chaseside Engrg. Co., Ltd., Enfield, Eng., mfrs. mining equipt.; 1935-38, director M. L. Curtis Ltd. of Enfield, England, genl. mech. engrs., later taken over by Ministry of Supply; 1938-39, prod. engr., Crompton Parkinson Ltd., Chelmsford, Eng., elect. engrs. and mfrs. of equipt., was i/c of all prod. switchgear; 1938-46, consultg. engr. to Associated Industrial Consultants Ltd., London, responsible for application of engrg. methods in various factories of company's clients; work covered mech. and elect. engrg. and iron and steel founding; at present, sr. engr. and supvr., responsible for application of company's engrg. methods in factories of clients, J. D. Woods & Gordon Ltd., industrial engrs., Toronto, Ont.

References: H. J. A. Chambers, G. G. Henderson, A. S. C. Ryley, G. W. Lusby, H. D. Harris.

DARLING—DOUGLAS GEORGE, of Toronto, Ont. Born at Hamilton, Ont., Dec. 22, 1920. Educ.: B.A.Sc. (Mech.); M.A.Sc., Toronto, 1943 and 1946 respectively; R.P.E., Ontario; 1941-42 (summers), Ordnance Divn., Otis-Fensom Elevator Co. Ltd., as machine operator, jr. planer; 1943-45, Lieut. (E), R.C.N.V.R; 1947 to date prod. engr., Toronto Brick Co. Ltd., Toronto, Ont.

References: E. A. Allcut, W. P. Dobson, E. H. Darling, R. W. Angus, G. R. Lord, R. C. Wiren.

DENHAM—DONALD, of Vancouver, B.C. Born at Malton, Yorks., Eng., Sept. 13, 1901. Educ.: Tech. College, Darlington, 1918-1922 (concurrently with apprent'ship); R.P.E., British Columbia, (by exam.); 1918-22, apprent., Robt. Stephenson, locomotive builders, Darlington, Eng.; 1923-35, Engr. Officer on S/S Empress of Australia, Metagama, Duchess of Atholl, Mont Royal, Montcalm, Empress of Japan; 1945 to date, Boilers and Machinery Inspection Dept., British Columbia, as engr. surveyor, inspector, and examiner, boilers and machinery.

References: F. B. Taylor, A. L. Swanson, C. C. Ryan, W. T. Fraser, J. G D'Aoust.

DEVALL—DOUGLAS HAROLD, of Arvida, Que. Born at Hamilton, Ont June 10, 1918. Educ.: B.A., McMaster Univ., 1941; 1945-46, asst. supt., responsible for all plant operations, including unloading, processing, and shipping; 1946 to date, chemist i/c of lab., ore plant No. 1, Aluminum Co. of Canada, Arvida, Que. (Applying for admission as Affiliate).

References: H. J. Bowden, E. F. Hartwick, G. M. Masson, D. F. Nasmith, W. J. Thomson.

FELDKAMP—KENNETH R., of Arvida, Que. Born at Brantford, Ont. Feb. 12, 1916, Educ.: B.A., (Chemistry), Cornell, Ithaca, N.Y. 1940 (Course not accredited E.C.P.D.); 1940, (4 mos.), supvr. constrn., G. F. Sterne & Co., Brantford, Ont. 1942-45, i/c work simplification, safety engr. and asst. engr. in mtce. dept., Canadian Industr Limited, Noiesbel, Ont.; at present, industrial engr., Aluminum Co. of Canada, Ltd., Arvida, Que.

References: J. P. Estabrooks, F. A. Dagg, J. E. Dyck, F. T. Boutilier, G. M. Mason.

FELDMAN—SAUL, of 427 Magnus Ave., Winnipeg, Man. Born at Winnipeg, Man., March 2, 1924. Educ.: B.Sc., (Elect. Engrg.), Manitoba, 1946; 1943, (summer), rodman, surveying on Alaskan Highway for U.S. Public Roads Admin.; 1945, (summer), 1946 to date, demonstrator, dept of. electrical engrg., Univ. of Manitoba.

References: E. P. Fetherstonhaugh, N. M. Hall, E. R. Love, A. E. Macdonald, G. H. Herriot.

GOLUBOWSKI—WIACZESLAW, of 3440 Shuter St., Montreal, Que. Born at Biskupice, Poland, June 29, 1903. Educ.: Mech. Engr., Technological Institute of Danzig, 1930; R.P.E., Quebec. (licensed); 1932-36, asst foreman, railroad factory, Poznan; 1936-39, prod. engr., State Aircraft Factory, Warsaw; 1939-40, inspectr., Kelluer & Beschereau, Paris; 1942-45, floor engr., Canadian Car & Foundry Co., aircraft divn., Montreal; 1945 to date, tool design cbecker, Canadair Limited, Montreal, Que.

References: M. Szymanski, B. Szczeniowski, N. L. Hartmann, J. Pawlikowski M. Weinreb.

HOLBROOK—GEORGE WILLIAM, Major R.C.E., of Kingston, Ont. Born at Asquith, Sask., Dec. 16, 1917. Educ.: B.Sc., (Eng.) Univ. of London, 1938; A.M., Inst. Elect. Engineers, London; 1934-38, (summers), Standard Telephones & Cables Ltd., London; 1938-39, lab. engr., European lab., Standard Telepbones & Cables and during period part-time post-grad. work, Woolwich Polytechnic; with Royal Canadian Signals, as follows: 1939-45, Officer, Armoured Formations, 1945-56, Grade II, Tech. Officer, Signals Research and Development Estab., Christchurch, England; 1946 to date, O.C. Line Group, with rank of Major, Kingston, Ont.

References: K. H. McKibbin, J. E. Genet, D. M. Jemmett, M. G. Sanders, J. E. Tbom.

KUHNS—ALLAN CHARLES, of 328 Clemow Ave., Ottawa, Ont. Born at Mount Pleasant, N.Y., Nov. 3, 1916. Educ.: B.Sc., (Civil), Queens, 1941; R.P.E., Ontario, 1939-40; (summers), surveyors asst., Ottawa surburban roads; 1941-42, instru'man., Canadian National Railways, Montreal; 1943-45, design engr., design work, dftng., layout and supvr. field work, J. R. Booth Ltd., Ottawa; 1946, (4 mos.), surveying and inspector on jobs, Farley & Cassels, consultg. engrs. and surveyors; 1946, (3 mos.), right of way survey 10 miles and dftng. same for registration, Ottawa Surburban Roads; at present, asst. planning engr., National Capital Planning Commission (Railway Committee), Ottawa, Ont.

References: T. Foulkes, A. K. Hay, W. L. Cassels, J. L. Shearer, C. G Biesenthal.

L'HEUREUX—JOSEPH FRANCIS RENE, of Chambly Basin, Que. orn at St. Jude, Que., Oct. 16, 1904. Educ: B.A.Sc., C.E., Ecole Poly., 1930; with Antbracite Institute of America, as follows: 1930-31, district engr., Montreal, 1931-33, mgr. for Quebec district, Anthracite Coal Service; 1933-36, engr. for Provincial Roads Dept.; 1936 to date, supt. Chambly Canal, Chambly Basin, Que.

References: J. A. Lalonde, H. Gaudefroy, A. Frigon, J. A. Beauchemin, H. Massue, L. Trudel.

MANN—CLARENCE W. J., of Sarnia, Ont. Born at Vancouver, B.C. July 27, 1920. Educ.: B.A.Sc., (Chem. Engrg.); M.A.Sc., (Chem. Engrg.), British Columbia, 1943 and 1944, respectively; with Imperial Oil Limited, as follows: 1944-46, plant cbemist, Sarnia refinery, 1946 to date, process engr., engrg. and development dept., Sarnia, Ont.

References: G. L. Macpherson, D. S. Simmons, C. P. Warkentin, W. Al Williams, T. B. Doherty.

MacLEAN—JAMES HERBERT, Capt., R.C.E.M.E., of Britannia Bay, Ont. Born at Toronto, Ont., Dec. 31, 1918. Educ.: B.A.Sc., (Mecb.), Toronto, 1941; R.P.E., Ontario; 1938-40, (summers), miner, Lamaque Gold Mines; power house mtce., Goodyear Tire & Rubber Co., New Toronto; mecb. mtce., Hollinger Gold Mines Ltd.; with R.C.E.M.E., as follows: 1941-45 Officer, Canadian Army, 1945-46, design engr., Ottawa Car & Aircraft Ltd., i/c design and development of Bouffard Log Loader & Winches; 1946, Officer, Canadian Army D.C.D., D.N.D., at present, Directorate of Vehicle Development, M.G.O. Branch, Dept of National Defence, Ottawa.

References: P. C. King, A. E. MacRae, E. A. Allcut, R. C. Wiren, G. R. Lord

MACKENZIE—KENNETH CHARLES MACGREGOR, of Atbolville N.B. Born at Lossiemouth, Scotland, Aug. 18, 1892. Educ.: Britisb Inst. Engrg. Technology, 1942-45; Assoc. Member, Inst. Mech. Engrs., London; apprent. fitter with: 1908-10, Watson Bros., Banff, Scotland, 1910-11, David Rowan Co. Glasgow; petroleum tech., Anglo-Persian Oil Co., as follows: 1913-20, asst. supt., supvr. constrn., genl, oil refinery operations, carried out design work on distillation plant, Adaban, Persian Gulf, 1919-20, acting refinery supt., responsible for all operations, 1920, supvr. constrn. for two years as asst. supt., Llandarcy, South Wales, 1923-25, development supt., designed, constructed and operated bigh vacuum distillation plant, etc. 1925-27, visited U.S.A. refineries to study and report on refining tecbnique, and gasoline recovery plant, studied and reported on oil blending and marketing business in Manchester; 1928-32, operating engr. and chief engr., International Paper Co., Dalhousie, N.B.; 1932 to date, steam generation supt., responsible for management of steam power plant, incl. efficient prod. of steam., care and repair of all equipt., Restigoucbe Co., Campbellton, N.F

References: F. O. White, L. Sterns, C. A. Robb, F. T. Peacock, C. A. Laverty, C. E. Bedford-Jones.

McADAM—WILFRID JOSIAS, of Montreal, Que. Born at Renfrew Ont., March 2, 1906. Educ.: B.Sc., (Civil Engrg.), Saskatchewan, 1932; R.P.E., Ontario; 1928-31, (summers), highway engr., Dept. Higbways, Sask.; 1931-32, instructor, dfting. and surveying, Univ. of Sask.; 1934-38, sales and design engr., heating, air-cond. and refrigeration, Canadian General Electric.; 1938-41, asst. power sales mgr., Winnipeg, Electric Co. Winnipeg, Man.; 1941-46, Capt., R.C.E.; 1946-47, chief engr., Wartime Housing Ltd., Toronto, Ont.; at present, asst. to chief engr., with particular reference to mechanical and technical trades, J. L. E. Price & Co., Ltd. Montreal, Que.

References: C. J. Mackenzie, J. L. E. Price, C. F. Morrison, E. A. Ryan, E. K. Phillips, A. Turner-Bone.

MICKLEBOROUGH—KARL FRANKLIN, of Ottawa, Ont. Born at St. Thomas, Ont., June 3, 1890. Educ.: B.A.Sc., Toronto, 1913; 1909-12, (summers), dftsman., instru'man., asst. engr., on sewers, paving, subways, street railway, City of Regina, Sask.; 1913-15, asst. engr., surveys from Prescott to Vaudreuil, i/c two parties, St. Lawrence Waterway Project; 1915-20, principal asst. i/c designs, estimates and constrn. of concrete, dams, wbarves, retaining walls, bridges, etc., St. Lawrence Canals, Cornwall, Ont.; Demerara Bauxite Co. Britisb Guiana,. 1920-22, asst. engr., i/c constrn. 25 mile railroad, bridges, mill bldgs., mine surveys and ore estimates; 1922-24, chief engr., i/c operation of mining and milling operations, genl. plant constrn.; with Dept. of Transport, as follows: 1925-31, sr. asst. engr., design and constrn. Cote St. Paul power house; Lacbine Canal, new lock at St. Ours, Ricbelieu River, Hawk Lake Dam, dam at Lock 22, Trent Canal, etc., 1931-38, sr. office engr., field inspections, supervising contract work, reports on engrg. projects pertaining to canals, 1938 to date, genl. asst. engr., Canal Services, asst. genl. supt. and suptg. engrs. in administration, operation and mtce. of canals of Dominion, Ottawa, Ont.

References: C. P. Edwards, E. B. Jost, D. W. McLachlan, E. P. Murphy, E. G. Cameron, C. W. West, D. A. R. McCannell, S. Hairsine.

SMITH—JOHN McCLEMENT, 9 De Savery Crescent, Toronto, Ont Born at Toronto, Ont., Dec. 9, 1916. Educ.: Graduate, R.M.C., 1939; B.Sc., (Civil), Queens,' 1941; R.P.E., Ontario; 1934-40, (summers), timekeeper, Routly Construction Co.; timekeeper, Municipal Paving Co. Ltd.; foreman, Municipal Paving Co., Ltd. Chairman, Trans-Canada Survey Party, Trans-Canada Highway, Ontario; foreman, Storms Contracting Co.; 1941-46, Platoon Officer, R. C.E.;1947 to date, jr. engr., (civil), Hydro Electric Power Commission of Ontario, Toronto, Ont.

References: H. Lawson, L. F. Grant, D. Forgan, G. Mitchell, R. M. Smith, J. E. Stark.

SWICK—MICHAEL VICTOR, of Hamilton, Ont. Born at Hamilton, Ont., Nov. 11, 1918. Educ.: B.A.Sc., (Mech. Engrg.), Toronto 1941; R.P.E., Ontario; with Steel Co. of Canada, Hamilton, as follows: 1937-40, (summers), labourer, sheet mill, machinist's helper, machine shop, combustion engrg. dept. and tin mill, 1941, (7 mos.), cbief inspector, plate mill; 1941-46, Officer, R.C.E.M.E., in Canada and overseas, mtce. all types mecb. equipt., fire control instruments, artillery and developt. and application of waterproofing all types of vehicles; 1946, hot strip mill—Hallden sbear line—temper mill, and at present, mech. engr., design, plant layout, preliminary design and estimating cost of future expansion, engrg. dept., Steel Co. of Canada, Limited, Hamilton, Ont.

References: C. J. Porter, A. E. Tuck, E. T. W. Bailey, R. E. Butt.

SZNAJDER—STANISLAW FELIKS, of Hamilton, Ont. Born at Moscow, Russia, Feb. 12, 1908. Educ.: B.Sc. (Civil Engrg.) Politechnika Warszawska, 1934; R.P.E., Ontario.; 1930, cbief engr., planning and surveying (3 mos.), Silesia-Gdynia Railway Co.; 1932, dist. engr., planning and supvr. of works, (3 mos.), Kalisz District of Public Works; 1933, city engr., planning and supvr. of works, (3 mos.), Kalisz City Engrg. Dept.; 1934-35, Military Service, Engrg. Corps; 1935-36, designing and planning, State Dept. of Communication; 1936-39, engaged by Engrg. Corps in Poand for bldg. of fortificatons, as asst. chief engr, later as chief engr., 10-mile sector, finally as chief engr. of 50-mile sector, work consisting of designing of military bldgs., estimate of costs, foundations, narrow-gauge rly. and drainage, surveying, concrete, reinforced concrete and steel struc., sewer system, elect. instlns., etc.; 1939-40 Military Service with Polish Army in Poland & France, as 2nd Lieut.; 1942-43 reinforced concrete, Aluminum Co. of Canada, Ltd., Montreal; with C. D. Howe Co. Ltd., as follows: 1944-46, reinforced concrete, structl. engrg. in general, Port Arthur, Ont., 1946 to date, structl. designer, i/c structl. design, Hamilton office.

References: J. M. Fleming, H. M. Olsson, H. Os, W. C. Byers, M. B. A. Culpeper.

TISON—MAURICE, of Montreal, Que. Born at Montreal, April 25, 1895. Educ.: 1915-17 and 1918-20, McGill Univ. (completed 2nd yr. engrg.); 1921-25, elect. design and dfting., Montreal Water Board; 1926-35, asst. chief engr., mtce and. operations, Electrical Commission, City of Montreal; 1936-39, inspectr. i/c H.T. instlns., Board of Electrical Examiners; 1940-41, design of dist. systems and sub-stations, Foundation Co. of Canada, St. Paul l'Hermite plant; 1942, aerodrome lighting layouts, etc. and control equipt., R.C.A.F. Works and Bldgs. Divn., Ottawa; 1943-45, elect. design of power and lighting for plants in all parts of world, H.T. and subs-stns., Aluminum Co. of Canada (Montreal engrg. office); 1945, design of elect. structures, ligbting and motor layouts, Canadian Comstock Co. Ltd., (Brompton Pulp & Paper plant at Red Lake, Ont.); at present, chief electrical instructor, Montreal Building Trades Apprenticeship Centre, Montreal, Que. (St. 1915; Jr. 1920; A.M. 1930-34).

References: C. J. Desbaillets, J. L. Davison, G. Rousseau, J. L. E. Price.

WARNER—FREDERICK RICHARD, of Cornwall, Ont. Born at Thorold, Ont., Sept. 30, 1904. Educ.: B.A.Sc., Toronto, 1926; R.P.E., Ontario; 1926-27, instru'man., street rly. rehab., Canadian National (Electric) Railways, St. Catharines, Ont.; 1927-30, engr., made final measurements, final estimates on large sewer and pavement contracts, worked in design and supvr. constrn. of municipal structures, Flevenor & Weller, Inc., civil engrs., Rochester, N.Y.; 1930-31, engr., prepared property maps in connection with gas drilling operns., Belmont Quadrangle Drilling Corp., Bradford, Pa.; 1931-33, office engr., i/c quantity measurements and records on Masson Power Develpt., James Maclaren Co., Buckingham, Que.; 1934-35, instru'man., Dept Northern Develpt., Ontario; 1935-40, sales engr., Consumers' Gas Co., Toronto; office engr. i/c quantity measurements, progress reports, and portion engrg. staff on constrn. explosives plant; 1941 to date, asst. engr., operation and mtce. Ontario-St. Lawrence Canals, Department of Transport, Cornwall, Ont.

References: S. Hairsine, W. F. Auld, E. A. Sudden, D. D. Whitson, E. B. Jost, J. Hawkes, J. R. Auld, D. C. Beam.

WHITEMAN—HARRY HILLIARD, of Montreal, Que. Born at Liphook Hamps., Eng. Aug. 1, 1918. Educ.: B.Sc., McGill, 1938; with Canadian Vickers, aircraft divn., as follows: 1939-40, engrg. clerk, engrg. drawing, breakdowns and releases, etc., 1940-41, engr. i/c under chief engr. of engrg. in connection with manufacture of "Stranraer" flying boats, involved develpt. of modifications to basic design, shop liaison engrg., approval of mfg. concessions, etc.; 1941-45, Aeronautical Engr., R.C.A.F., Officer i/c Workshops, Progress Officer, O.C. Inspecn. Section, O.C. Mtce. Squadron, all No 4 Repair Depot; Staff Engr. Officer, Eastern Air Command H.Q.; Develpt. Engr. (Figbter Types), Air Force H.Q.; Prod & Develpt. Engr. (Figbter, Bomber, Light Bomber Type), A.F.H.Q.; Engr. i/c Develpt. and Mtce, all operational types, A.F.H.Q.; Deputy to O/C Airframe Develpt. and mtce. Grp.; 1945 to date, chief project engr. i/c project engrg. for conversion of military C47 and C53 aircraft to DC3 civil types, repair and conversion, Canadair Limited, Montreal, Que.

References: B. W. King, D. O. Stapleton, D. C. McCallum, W. H. C. Wallis E. C. V. Norsworthy, P. W. Gooch.

WILLIAMS—EGBERT R., of Shawinigan Falls, Que. Born at Toronto, Ont., Oct. 24, 1889. Educ.: B.A.Sc., Toronto, 1912; 1912-13, American Cyanide Co.; 1913-15, foreman, Aluminum Company; 1917-20, Army; with Shawinigan Chemicals Ltd. ,as follows: 1920-42, dept. and divisional works supt., 1942 to date, works mgr., Shawinigan Falls, Que.

References: J. McCrory, R. E. Heartz, G. R. Rinfret, A. Surveyer, J. S. Whyte, H. K. Wyman.

WOOD—THOMAS ARCHIBALD, 1207 Marine Drive, Hollyburn, B.C. Born at Victoria, B.C., June 19, 1897. R.P.E., British Columbia, (by exam.); 1913-17 and 1919, (6 mos.), apprent'ship., Canadian Pacific Steamships; 1920-27, engr. officer Canadian National Steamships; 1928-29, engr., B. C. Pulp & Paper Co., Port Alice; 1929-30; chief engr., Hanbury Mills, Vancouver; 1931-36, chief engr., Hillcrest Lumber Co., Duncan, B.C.; 1936, (6 mos.), chief engr., Alberni Pacific Lumber Co., Port Alberni, B.C.; 1936 to date, inspector of boilers and machinery, and engr. surveyor, Government of British Columbia, Vancouver, B.C.

References: W. A. Bain, W. T. Fraser, C. W. E. Locke, A. L. Swanson, W. A. Wood.

FOR TRANSFER FROM THE CLASS OF JUNIOR

ALTON—WILLIAM, Major, R.C.C.S. of Kingston, Ont. Born at St. Helens, England, Aug. 29, 1915. Educ.: B.Sc. (Pbysics) Queen's, 1938; 1935 (3 mos.) Jr. engr., Tech Develpt. Div., Northern Electric Co.; 1938-39, R.C. Signals (Lieut.), 1939-40, Cmd. Field Regt. Signal section; 1941-43, Artillery

Signals, 1st and 2nd Cdn. Corps; 1943-45, Telegraph operating coy; 1945 (9 mos.), 2nd in command of Signals, 2 Cdn. Inf. Div.; 1946 to date, O/C advanced training coy. and chief instructor, Royal Can. School of Signals, Kingston, Ont. (Jr. 1940).

References: J. E. Genet, D. M. Jemmett, K. M. McKibbin, J. E. Thom, A. O. Monk.

BARBER-STARKEY, JOSEPH WILLIAM MAINGUY, of Ganges, B.C. Born at Shrewsbury, Eng., Sept. 28, 1918. Educ.: Royal Naval Engrg. College, Davenport, Eng., 1937-40, (passed for Lieut.(E), 1940); recommended for advanced engrg. course Royal Naval Coll. Greenwich; 1937-40, engrg. training, experience in destroyers, all types dockyard workshops; 1941, (4 mos.), Eng. Officer, i/c mach. and boilers, operating aircraft catapult; 1942, (3 mos.), Asst to Engr. Officer, H.M.C.S. Naden, drawing up notes on ship constrn. for R.C.N. Coll.; 1942-43, (7 mos.), Asst. to Supvr. Naval Engr., Pacific Coast, overseeing constrn. of Frigates at Yarrows Ltd.; 1943, (5 mos.), Office i/c and Chief Instructor for engrg. course for 50 Sub. Lieuts.(E) R.C.N.V.R., Halifax; 1945, (6 mos.), Asst. to Supt. at Yarrows Ltd.—co-ordinating constrn. and planning programme for alterations and repairs to 3 Frigates; 1946, (6 mos.), diesel engr. with B.C. Power Commission, training as operator; 1947 to date, operating Vesuvius Marine Service, Ganges, B.C. (mainly for reasons of health). (Jr. 1945).

References: B. R. Spencer, A. D. M. Curry, A. C. M. Davey, E. W. Izard, N. A. Yarrow, G. Griffiths, G. A. Vandervoort.

ECKENFELDER—GEORGE VICTOR of Calgary, Alta. Born at Trochu Alta, May 22, 1910. Educ.: B.Sc. (Civil) Alberta 1933; summer jobs as follows: 1927 and 1928, chairman, railway constrn., C.N.R.; 1929 and 1931, rodman, C.N.R.; 1933, Coxwain, Hydrographic Service of Canada, Mackenzie Delta Survey; 1933-34 camp foreman, Dept of National Defence, unemployment relief projects; 1934-35, asst. engr., airport and highway constrn. Nat. Defence; 1935-36, engr. i/c of forestry project. constrn. of roads. buildings etc.; 1936-40 jr. engr., Calgary Power Co., mtce. of structures, stream flow, measurement, preliminary designs, cost estimates of hydro develpt., studies of industrial power requirements; 1940-45, R.C.C.S. (Capt.), overseas; 1945 to date, resident engr. i/c of constrn. of Barrier Hydro-Elect. Develpt., Calgary Power Co. Ltd., Seebe, Alta. (St. 1932. Jr. 1937).

References: G. A. Gaherty, H. J. McLean, T. D. Stanley, H. Randle, R. M. Hardy.

JOHNSTON—WILLIAM DAVID, of Toronto, Born at Toronto, Sept. 21, 1913. Educ.: B.A.Sc. (Civil) Toronto 1935; R.P.E. of Ont.; 1935-46, designing, estimating, i/c of plate, tank design, Dominion Bridge Co. Ltd., Toronto, 1947, chief engr., Ideal Welding Co. Ltd., Toronto, (St. 1935. Jr. 1942).

References: W. H. M. Laughlin, E. R. Graydon, H. S. Irwin, G. P. Wilbur, H. W. Short, R. S. Segsworth.

MEREDITH—WILLIAM RALPH, of Ottawa, Ont. Born at Burford, Ont. Nov. 1, 1916. Educ.: B.Sc. (Mech.) Queen's 1945; R.P.E. of Ont.; summer jobs as follows: 1936, surveying, Dept of Highways, 1939; plant engrg., Fetherstonhaugh & Co.; 1943, engrg. work, Aluminum Co. of Canada; 1944-45, R.C.E.M.E. technical course; 1945 to date, patent engrg. consultant, giving opinions as to validity of patents to Gowling, MacTavish, Watt, Osborne and Henderson, Ottawa. (St. 1944. Jr. 1947)

References: D. S. Ellis, R. O. McGee, T. R. Rutledge, N. Marr, D. G. Kilburn, L. A. Fraikin.

MILLER—JOHN LEONARD, of Vancouver, B.C. Born at Saskatoon, Sask. on Oct. 5, 1917. Educ.: B.Sc. (Civil) Sask. 1941; R.P.E. of British Columbia; summer jobs with A. W. Cassidy as follows: 1938, timekeeper, 1939 labor foreman, Trail, B.C.; with Arthur Pearson, Consulting Engr. as follows: 1941-43, dftsman; 1943, group engr., material substitution, Boeing Aircraft; 1944, Jr. engr.; 1946 to date chief structural draughtsman, Vancouver, B.C. (St. 1941. Jr. 1946)

References: A. Pearson, F. R. Phillips, C. J. McKenzie, R. A. Spencer E. A. Hardy, E. K. Phillips.

SAARI—ROY AUGUST, of Fort William, Ont. Born at Jackson, Michigan, on Nov. 18, 1922. Educ.: B.Sc. (Elect.) Manitoba, 1946; 1939-42, summers, Canada Car & Foundry Co. Ltd.; 1943-44, part time, Manitoba Bridge & Iron Co. Ltd., Winnipeg, Man.; 1946-47, asst. project engr. in wire recording, responsible for research devlpt. testing, fidelity and performance of associated amplifiers, Commonwealth & Southern Power Co., Jackson, Michigan. (St.1945)

References: E. P. Fetherstonhaugh, N. M. Hall, E. R. Love, G. H. Herriot.

WILDE—WILLIAM CLAYTON of Calgary, Alta. Born at Calgary on May 26, 1913. Educ.: B.Sc. (Elec.) Alberta 1936; 1931-32, apprentice in Toll Telephone Switchroom, Alberta Government Telephones; with Automatic Electric Canada Ltd. as follows: 1936-37, sales engr.; 1937-40, sales engr and branch mgr.; 1940-45, R.C.C.S. (Capt.) O/C 7th L.A.A. Signal Section, Admin. transport officer No. 1 Can. Signals re-inforcement unit; 1945 to date, branch mgr. and sales engr., Automatic Electric Canada Ltd., Edmonton, Alta. (Jr. 1938).

References: T. A. Lindsay, A. Sandilands, T. W. Brackenreid, A. M. Allen, J. McMillan.

WISHART—WILLIAM DONALD, Lt.-Col., R.C.C.S., of Ottawa, Ont. Born at Portage la Prairie, Man. on Jan. 19, 1907; Educ.: B.Sc. (Elect.) Manitoba 1931; with R.C.C.S. as follows: 1942-43, General Staff Officer, branch Hdqts, adviser to chief signal officer on line communications, i.e. telephone and telegraph equipment, line construction; 1943-45, O/C 1 st. Can. Line of Communication Signals, N.W. Europe, duties included construction of new line routes, rehabilitation of civil routes, installation of equipt. for repeater stations, switching centres; Jan. 1946—Oct. 1946, Chief Instructor, R. C. School of Signals; at present, G.S.O.I. Telecommunications—Directorate of Signals Army, Ottawa, (St. 1932. Jr. 1934)

References: W. M. Veitch, K. H. McKibbin, H. W. Love, G. R. Turner, F. F. Fulton, H. L. Meuser.

WRIGHT—H. SINCLAIR, of Maracaibo, Venezuela. Born at St. Peters, N.S. on April 14, 1905. Educ.: B.Sc. (Mech) N.S.T.C. 1927; with Demerara Electric Co. Ltd. as follows: 1929-31, chief engr.; 1931-46 general supt.; 1946, to date, production supt. Maracaibo, Venezuela. (St. 1922. Jr. 1941).

References: J. H. McLaren, J. T. Farmer, H. McLean, E. A. Goodwin, J. H. Reid, F. H. Sexton, A. C. D. Blanchard.

FOR TRANSFER FROM THE CLASS OF STUDENT

BELANGER—CECILIEN, of Quebec City. Born at Sayabec on April 20, 1922. Educ.: B.A.Sc. (Met.) Laval, 1946; 1939 (3 mos.) Cournor Gold Mines as mucker; 1942 (4 mos.) survey, Foundation Co. Ltd.; 1943 (8 mos.) AICAN, technical dept.; 1945 (4 mos.) Fraser Brace Co. Ltd., reinforced steel; 1946, chief inspector, The Central Mortgage & Housing Corp., Quebec, Que. (St.1944)

References: R. Dupuis, D. Fraser, P. E. Gagnon, G. E. Sarault, A. Pouliot.

MARTIN—WILLIAM ANDERSON, of Toronto, Ont. Born at Orillia, Ont. on Feb. 4, 1918. Educ.: B.A.Sc. Toronto, 1946; summer work as follows: 1940, refiner, Inst. Nickel Co., Port Colborne; 1941, heat treater, Can. Acme Screw & Gear Co.; also in 1941, metallurgist, Aluminum Gords Ltd., Munitions Branch, Lambton, quality control work on 40 mm. cartridge cases; at present, metallurgist, General Electric, Davenport Works, lab. control of welding, heat treating, metall. analysis, photomicrography, Toronto (St. 1946).

References: C. E. Sisson, D. Norman, W. S. Wilson, E. A. Allcut, C. G. Williams, R. J. Waines.

WONG—P. HUEY, of Montreal, Que. Born at Canton, China, on Sept. 15, 1915; Educ.: B.Eng. Kuo-Min University, Canton 1937; 1942-44, McGill Univ.; 1946, S.M. (Civil Engrg.) M.I.T.; summer jobs as follows: 1943, engr. D.I.L.; 1944 and 1945, stress analyst, Canadair Ltd; 1946, design engrg. Stone & Webster; at present, instructor at McGill Univ., Montreal (St. 1943).

References: P. Gooch, G. J. Dodd, R. E. Jamieson, C. A. Robb, E. Brown.

LIBRARY NOTES *(Continued from page 141)*

reagents and sampling. Of particular interest and importance are several new photometric procedures. Five spectrochemical analysis methods are also included.

DESIGNING with MAGNESIUM:

American Magnesium Corporation, subsidiary of Aluminum Company of America, New York, 1945. 323 pp., illus., diagrs., charts, tables, 8½ x 5¼ in., fabrikoid, gratis.

The rise in the use of magnesium as a structural material is reflected in this new book. The early chapters discuss the properties of magnesium, when and why magnesium is desirable, and the choice of fabrication methods. Succeeding chapters take up these fabrication methods in detail, with critical comments on their special features or faults with regard to various uses. The last three chapters present design considerations for casting, forging, and structural work. There is a large section of tables of technical data relating to magnesium.

ELEMENTARY HEAT POWER:

H. L. Solberg, O. C. Cromer and A. R. Spalding. John Wiley & Sons, New York; Chapman & Hall, London, 1946. 480 pp., illus., diagrs., charts, maps, tables, 8½ x 5½ in., cloth, $5.70.

This new text aims to develop an understanding of the functions, principles of construction, and actual performance of heat-power machinery as a preliminary to the study of engineering thermodynamics. Consideration of matter and energy, fuels and combustion are first given, followed by chapters on internal-combustion engines, fuel-burning equipment, and steam-generating and utilizing installations. Pumps, compressors and other auxiliary equipment are dealt with, and there are also brief chapters on the gas turbine and mechanical refrigeration.

HEATING and AIR CONDITIONING:

J. R. Allen, J. H. Walker and J. W. James. 6th ed. McGraw-Hill Book Co., New York and London Embassy, Toronto, 1946, 667 pp., illus., diagrs., charts, tables, 9¼ x 6 in., cloth, $5.00.

The new edition of this standard text has been revised as needed to bring it up to date. In addition to the revision of existing material, a new section on panel heating is included and the principle of a reversed-cycle refrigeration system has been treated from a theoretical and practical viewpoint. A feature of the book is a detailed discussion of the design of an actual air conditioning system. The book is suitable both for the engineering student and for home study.

HIGHER MATHEMATICS for Students of Chemistry and Physics:

J. W. Mellor, Dover Publications, New York, 1946. 641 pp., diagrs., charts, tables, 8¾ x 5½ in., cloth $4.50.

Mathematical concepts and methods are introduced and discussed in close connection with the manipulation of the results of physical or chemical observations. The mathematical fields dealt with are as follows: calculus, analytical geometry, infinite series, differential equations, Fourier's theorem, probability and the theory of errors, calculus of variations, determinants, certain special functions, and the solving of numerical equations.

METALLURGY of QUALITY STEELS:

C. M. Parker, Reinhold Publishing Corp., New York, 1946. 248 pp., illus., diagrs., charts, tables, 9¼ x 6 in., cloth, $6.00.

Following a brief chapter on the general nature of steel, this introductory text discusses steel quality as related to methods of manufacture, chemical composition and control, ingot and rolling practice. Heat treating, testing and inspection procedures are described, and the effects of alloying and incidental elements are considered. Hardenability and other special characteristics are dealt with, and a final chapter tabulates the general characteristics of standard steel grades.

Employment Service

The service is operated for the benefit of members of The Engineering Institute of Canada, and for industrial and other organizations employing technically trained men—without charge to either party. It would therefore be particularly appreciated if employers would make the fullest possible use of these facilities to make known their existing or estimated requirements. Notices appearing in the Situations Wanted column will be discontinued after three insertions, and will be re-inserted upon request after a lapse of one month.

Situations Vacant

CHEMICAL

CHEMICAL ENGINEER, recent graduate up, preferably with experience, required for production work by a chemical firm in Shawinigan Falls, Quebec. Salary $175 to $250. Apply to File No. 3769-V.

GRADUATE CHEMICAL ENGINEER required by a Montreal firm to supervise and control Chemical plant engaged in production of fine chemicals about 60 miles from Montreal. Preferably with actual experience in bandling both laboratory and plant personnel. Salary open. Apply to File No. 3783-V.

CHEMICAL ENGINEER with knowledge of how to treat sulphate or failing this sulphite and soda pulp, required as Regional Manager by a large paper company in Northern Ontario. Executive and management ability necessary. Permanent position. Salary $15,000. Apply to File No. 3808-V.

CIVIL

CIVIL ENGINEER with considerable experience in the design and construction of structural steel and reinforced concrete structures, required by a firm of consulting engineers in Toronto. Salary open. Apply to File No. 3753-V.

CIVIL ENGINEER is required to act as Town Engineer and take complete charge of the engineering service of a town in Ontario. Maximum salary $3,000. per annum. Apply to File No. 3782-V.

GRADUATE CIVIL ENGINEER required by an industrial corporation in Montreal for design work in draughting room. Must be familiar with structural steel and concrete design. Position offers good opportunity and permanency to right man. Salary from $250 up according to experience, Apply to File No. 3785-V.

ELECTRICAL

GRADUATE ELECTRICAL ENGINEER with 5 or more years experience in electrical equipment of buildings, required by a consulting engineer in Montreal. Salary open. Apply to File No. 3773-V.

GRADUATE ELECTRICAL ENGINEER witb at least three years experience, preferably construction required by a manufacturer in Central Ontario, to supervise electrical installations on construction jobs. Salary open. Apply to File No. 3775-V.

GRADUATE ELECTRICAL ENGINEERS with 3 to 10 years experience in design, operation, layout of substations, switching stations, and electrical machinery, together with engineering studies, including draughting for a large hydro electric power house in Quebec. Salary $225 up. Apply to File No. 3787-V.

GRADUATE ELECTRICAL ENGINEER, required to train as Sales Engineer witb National organization. Permanent position. Must be prepared to be stationed in Alberta or Saskatchewan. Reply giving full particulars. Enclose photo when answering. Apply to File No. 3790-V.

MECHANICAL

MECHANICAL ENGINEER with 5 or more years experience in heating, ventilating and air-conditioning, required by a consulting engineer in Montreal. Salary open. Apply to File No. 3773-V.

JUNIOR MECHANICAL ENGINEER, required by a manufacturer in Central Ontario, to be responsible to Mechanical Superintendent. Salary open. Apply to File No. 3774-V.

MECHANICAL ENGINEER, with paper mill or mining experience required for design and layout by a paper mill in Northern Quebec. Salary $375-400. Apply to File No. 3778-V.

MECHANICAL ENGINEER with considerable experience willing to act as assistant to Mechanical Superintendent of a textile manufacturing concern near Montreal. Salary open. Apply to File No. 3784.-V.

SENIOR MECHANICAL DRAUGHTSMAN, age 25 to 45, with at least 5 years mechanical design and detailing experience, required for the mechanical department of an industrial organization in Montreal. Salary from $230 up according to experience. Apply to File No. 3786-V.

MECHANICAL ENGINEER, recent graduate up, required by a Pulp and Paper Company in the Province of Quebec for work entirely centred in logging operations. Salary open. Apply to File No. 3789-V.

MECHANICAL ENGINEER, recent graduate up, required by major oil company in Montreal area. Salary $175 up according to experience. Apply to File No. 3792-V.

MISCELLANEOUS

TECHNICAL GRADUATE, preferably Mechanical, Chemical or Electrical, under 30, veteran preferred, for permanent position with engineering organization. Training period in U.S. Work will include travelling for consultation among leading industrial plants. Enclose photo wben answering. Salary open. Apply to File No. 3759-V.

ROD-MEN AND INSPECTORS up to ASSISTANT PROJECT ENGINEERS, wanted by an American Engineering firm for an employment contract in Alaska for one year. Board and room furnished also transportation from point of hire. Excellent salary. Apply to File No. 3776-V.

STRUCTURAL STEEL DRAUGHTSMAN, qualified to detail and check all classes of structural steel and to supervise draughtsmen in a large drawing office on the West Coast. Salary open. Apply to File No. 3777-V.

DESIGN ENGINEER to make investigations and preliminary drawings of cost estimates of alterations to buildings and machinery for a large paper mill in the St. Maurice Valley. Salary around $300. Apply to File No. 3779-V.

MECHANICAL OR ELECTRICAL ENGINEER, age 25-35, required as field service engineer, to handle technical refrigeration service and maintain liaison with national distributors, dealers and service organizations, in the Provinces of Canada, for an American firm. Salary $300-350. Enclose photo when answering. Apply to File No. 3781-V.

GRADUATE CIVIL OR MECHANICAL ENGINEERS with 3 to 10 years experience in design, cost estimates, draughting, and engineering studies for a large hydro-electric power house in Quebec. Salary $225 up. Apply to File No. 3787-V.

SALES ENGINEER with electrical engineering background in public utility or industrial field required by wire and cable manufacturer for engineering contact work in Ontario. Salary open. Apply to File No. 3788-V giving complete details.

GRADUATE ENGINEER with experience in pre-stressed concrete and pipe manufacture, required by construction firm in Montreal area, veteran with administrative experience preferably. Salary open. Apply to File No. 3793-V.

GRADUATE, with some knowledge of looms, weave construction and clotb analysis, required as manager for rayon weaving plant in Peru. Administrative ability necessary. Knowledge of Spanish would be an advantage although not a necessity. Salary open. Apply to File No. 3794-V.

GRADUATE ENGINEERS, not exceeding 45 years, required by Contracting firm in Western Canada for railway construction and higbway work. Salary $300. Apply to File No. 3795-V.

The following advertisements are reprinted from last month's Journal, having not yet been filled.

CHEMICAL

CHEMICAL ENGINEER OR CHEMIST, preferably witb Pb.D., required by a pulp and paper company with plants in Eastern Canada, for research work. Salary open. Apply to File No. 3549-V.

CHEMICAL ENGINEER required by a pulp and paper company with plants in Eastern Canada, for mill control and pilot plant work. Salary open. Apply to File No. 3549-V.

CHEMICAL ENGINEER required by a petroleum refining company in Montreal for process and design work. Salary about $225. Apply to File No. 3575-V.

CHEMICAL ENGINEER required as assistant professor of chemical engineering in a Canadian university to start autumn 1947. Salary open. Apply to File No. 3600-V (D).

CHEMICAL ENGINEERS OR CHEMISTS for analytical work in tbe laboratory of an industrial firm in Central Ontario. Salary from $175. Veteran preferred. Apply to File No. 3642-V.

CHEMICAL ENGINEER. preferably with sales experience, for sales and service with an industrial firm in Central Ontario. Salary open. Apply to File No. 3642-V.

CHEMICAL ENGINEERS, both with experience and recent graduates, required by an industrial organization in the St. Maurice Valley. Salary open. Apply to File No. 3644-V.

CHEMICAL ENGINEER recent graduate up, to be assistant to tbe department superintendent of a tar distillery in the Toronto area. Salary $225. Apply to File No. 3674-V.

CHEMICAL OR METALLURGICAL ENGINEERS, from recent graduates up, required by a Quebec firm engaged in metal production for employment as production and development engineers. Salaries open. Apply to File No. 3693-V.

CHEMICAL ENGINEER, recent graduate, required as process engineer in production control by a manufacturer in Central Ontario. Salary open. Apply to File No. 3708-V.

JUNIOR CHEMICAL ENGINEER required for the control department of a paper mill in Shawinigan Falls. Salary from $175-$275. Apply to File No. 3765-V.

CIVIL

CIVIL ENGINEER with experience in the mechanical trades required as designer by a building contractor in Quebec, age 30-35, salary open. Apply to File No. 3444-V.

CIVIL ENGINEER to take charge of work in a drainage district in Quebec. Must be bilingual. May be recent graduate. Salary from $200. Apply to File No. 3479-V.

CIVIL ENGINEER for design work in an industrial plant in the Montreal area with experience in building construction, probably permanent position, salary from $200 up according to experience. Apply File No. 3504-V.

CIVIL ENGINEERS with experience in detailing and designing structural steel and reinforced concrete for manufacturers are required for a steel fabricating company in Manitoba. Salary open. Apply File No. 3519-V.

CIVIL ENGINEERS, recent graduate up, required by a pulp and paper company with plants in Eastern Canada. Salary open. Apply to File No. 3549-V.

CIVIL ENGINEER, age 35-40, with extensive experience in detailing and checking structural steel in buildings and bridges, required by a steel fabricating company in Southern Ontario. Salary open. Apply to File No. 3570-V.

CIVIL ENGINEER, senior designer, experienced in reinforced concrete and structural steel and general building construction, required to take charge of structuraldesign staff for a firm of consulting engineers in Montreal. Salary $300-$400. Apply to File No. 3585-V.

CIVIL ENGINEERS with master's degree, teaching and consulting experience, age 28-40, required for the staff of a university in N.Y. State. Salary open. Apply to File No. 3600-V (C).

CIVIL ENGINEER, preferably with railroad experience, required by a company engaged in large scale asbestos production in Quebec to supervise construction of local railroad. Salary open. Apply to File No. 3683-V.

CIVIL ENGINEER, recent graduate up, required for government organization on West Coast, to carry out field surveys, investigations of water resources and their application and to make reports, maps, plans, etc. Salary $200 up. Apply to File No. 3724-V.

CIVIL ENGINEERS, from recent graduates up, required by a public utility in Toronto for the design and construction of dams, bridges and power houses. Salary open. Apply to File No. 3736-V.

CIVIL ENGINEER, with at least five years' experience, to be assistant to the Director of Community Planning of the Province of Saskatcbewan. Starting salary $200-$250. Apply to File No. 3746-V.

CIVIL ENGINEER with experience in survey and construction, preferably bilingual, required to take charge of the engineering department for tbe woods operations of a paper company in Eastern Quebec. House available. Salary $350 up. Apply to File No. 3749-V.

CIVIL ENGINEER, qualified O.L.S., required as town engineer and superintendent of works for a town in Central Ontario. State age and salary desired. Apply to File No. 3750-V.

GRADUATE CIVIL ENGINEER, required by a public utility in the Montreal area with three or four years' experience in design of reinforced concrete and structural steel. Salary $250-$300. Apply to File No. 3766-V.

GRADUATE CIVIL ENGINEER, required as structural designing engineer by a firm engaged in the manufacture of cranes, crushers, pumps, etc., in the Toronto area. Preferably with 5 to 10 years' experience in designing and detailing steel buildings and bridges. Salary open. Apply to File No. 3771-V.

ELECTRICAL

ELECTRICAL ENGINEER, age 32-36, with electrical experience around mines or smelters. English speaking with working knowledge of French, is required by a company in Shawinigan Falls, Quebec. Salary open. Apply to File No. 3415-V.

ELECTRICAL ENGINEER age 30-45 with sales training with large manufacturer of electrical equipment instruments and 5-10 years experience as sales service and sales engineer required as sales engineer in Canada for U.S. firm making special equipment for transport and industry. Salary open. Apply to File No. 3447-V.

ELECTRICAL ENGINEER, recent graduate, required for the engineering staff of a paper mill in the Lake St. John area. Salary open. Apply to File No. 3507-V.

ELECTRICAL ENGINEERS, from recent graduates up, required by a company in Montreal engaged in the production of telephone, etc., equipment Veterans preferred. Salary open. Apply to File No. 3551-V.

ELECTRICAL ENGINEER for sales engineering, with previous experience, age 25-40, required by a Montreal firm handling pumps, valves, automatic controls, etc. Salary according to experience. Apply to File No. 3614-V.

ELECTRICAL ENGINEER with knowledge of power apparatus, preferably bilingual, required for sales work with a manufacturer in the Montreal area. Salary open. Apply to File No. 3646-V.

ELECTRICAL ENGINEER with considerable industrial experience required as a safety engineer by a public utility in the Montreal area. Bilingual preferred. Salary open. Apply to File No. 3654-V.

ELECTRICAL ENGINEER to be chief engineer, responsible for electrical and mechanical design and testing, required by a firm in Ontario manufacturing electric motors. Salary open. Apply to File No. 3656-V.

ELECTRICAL ENGINEER with several years experience required as a designer by an industrial organization in Montreal. Salary open. Apply to File No. 3677-V.

ELECTRICAL ENGINEER, with general knowledge of a.c. and d.c. motors, switchgear, mercury rectifiers, transformers and other electrical apparatus, for sales work in Eastern Canada, age 30 to 35, salary open. Apply to File No. 3695-V.

ELECTRICAL DRAUGHTSMAN with several years' experience in industrial layouts for large concern in Eastern Townships. Permanent position and attractive salary available for experienced men. Apply to File No. 3701-V.

ELECTRICAL ENGINEER, age about 30, with considerable experience, required by a manufacturer in the St. Maurice Valley. Salary open. Apply to File No. 3723-V.

ELECTRICAL ENGINEERS experienced in the design and installation of private communication systems required for a public utility in Toronto. Salary open. Apply to File No. 3736-V.

ELECTRICAL ENGINEER, with at least five years experience on overhead and underground transmission and distribution systems. Required as distribution engineer by a public utility in Brazil. Salary open. Apply to File No. 3738-V.

ELECTRICAL DESIGNING DRAUGHTSMAN with broad practical experience and theoretical knowledge required for a firm in Quebec. Salary from $225. Apply to File No. 3743-V.

ELECTRICAL DESIGNING DRAUGHTSMAN with considerable industrial experience and initiative required by an electrical firm in Montreal. Salary open. Apply to File No. 3751-V.

ELECTRICAL ENGINEER with estimating and contract experience, required as office engineer by an electrical firm in Montreal. Salary open. Apply to File No. 3751-V.

ELECTRICAL ENGINEER, recent graduate up, required by a manufacturer in Montreal, for sales engineering. Preferably bilingual and familiar with rotating electrical equipment. Salary $200. up. Apply to File No. 3761-V.

JUNIOR ELECTRICAL ENGINEER, required to act as assistant in an engineering sales office of an electrical firm in the Montreal area. Salary open. Apply to File No. 3768-V.

GRADUATE ELECTRICAL OR MECHANICAL ENGINEER, must have thorough knowledge of fractional H.P. Motors required by a Montreal firm to take charge of small engineering department. Salary $350-$500. Apply to File No. 3770-V.

MECHANICAL

MECHANICAL ENGINEER, is required for draughting and detail work with a company in central Ontario. Good prospects for advancement. Single man preferred. Salary open. Apply to File No. 3393-V.

MECHANICAL ENGINEERS, preferably with design experience, are required for armament research and development in the Quebec area, in a government establishment. Salary from $190. Apply to File No. 3401-V.

MECHANICAL ENGINEER, with mine mechanical draughting experience, for producing gold mine in Quebec. Apply to File No. 3436-V, stating experience, references and salary expected.

MECHANICAL ENGINEER with experience in pulp and paper work is required as draughtsman for a company in New Brunswick. Salary is open according to qualifications. Apply to File No. 3471-V.

MECHANICAL ENGINEER with paper mill experience for design and layout in connection with the re-conversion of a paper mill in Eastern Quebec. Salary from $200-$350 according to experience. Apply to File No. 3497-V.

MECHANICAL ENGINEER with experience in pulp and paper or mining work required by a pulp and paper company with plants in Eastern Canada. Salary open. Apply to File No. 3549-V.

MECHANICAL ENGINEER from recent graduates up, preferably with paper and pulp experience, required by a firm in the St. Maurice Valley. Salary according to experience. Apply to File No. 3573-V.

MECHANICAL ENGINEERS to be design squad leaders on heavy machinery design required by a company in Central Ontario. Salary open. Apply to File No.3623-V.

MECHANICAL ENGINEER recent graduate, required by an industrial firm in south western Quebec, for the design and erection of complex textile machinery. Salary open. Permanent position. Apply to File No. 3625-V.

JUNIOR MECHANICAL ENGINEER with construction or machine shop experience, required by a Montreal firm handling heavy construction equipment. Salary open. Apply to File No. 3635-V.

MECHANICAL ENGINEER with experience in the fabrication of Farm Implements, required by a Quebec firm. Bilingual man preferred. Salary according to experience. Apply to File No. 3666-V.

MECHANICAL ENGINEER with experience in the design of industrial machinery required by a Montreal firm manufacturing custom built machines. Salary $200-$250. Apply to File No. 3669-V.

MECHANICAL ENGINEER with design experience in the pulp and paper industry required by a firm with headquarters in Montreal. Salary $350. Apply to File No. 3673-V.

JUNIOR MECHANICAL ENGINEER with knowledge of precision machine shop practice and aptitude for research work in metals and plastics required for an organization in Toronto for the production of artificial limbs. Must be veteran. Salary from $225. Apply to File No. 3675-V.

MECHANICAL ENGINEER with industrial or construction experience, required by a firm of consulting engineers to inspect machinery deliveries in the Cornwall area. Salary open. Apply to File No. 3691-V.

MECHANICAL ENGINEER, recent graduate up, required for maintenance and production engineering by an industrial firm in Montreal. Salary open. Apply to File No. 3692-V.

MECHANICAL ENGINEERS, age 25-35, required by a manufacturer in Montreal, for training as sales engineers and for executive positions. Salary from $200. Apply to File No. 3710-V.

JUNIOR MECHANICAL ENGINEER, under 30 and preferably bilingual, required by a Montreal firm to train as sales engineer for pumps, engines and allied electrical equipment. Salary open. Apply to File No. 3714-V.

MECHANICAL ENGINEER, under 45, with at least ten years' experience in design of heating, ventilating and refrigeration layouts, required as heating engineer for a government organization on West Coast. Salary $250-300. Apply to File No. 3724-V.

YOUNG MECHANICAL ENGINEERS, with practical experience either in automotive or general manufacturing industries, together with ability to operate engineering office systems, required by an industrial organization in Ontario. Salary open. Apply to File No. 3732-V.

MECHANICAL ENGINEERS, with at least five years' experience in the Pulp and Paper industry required by an Ontario Paper Company. Salary open. Apply to File No. 3733-V.

SENIOR MECHANICAL ENGINEER, ten to fifteen years' experience required by a West Coast manufacturer of heavy equipment and vehicles to take charge of engineering design and inspection departments. Salary about $350. Apply to File No. 3734-V.

MECHANICAL ENGINEERS, with experience in plant layouts and design or ventilation problems or general mechanical design, required by a firm in Quebec. Salary from $250. Apply to File No. 3743-V.

MECHANICAL DESIGN DRAUGHTSMAN with experience in reinforced concrete and structural steel required by a mining company in Northern Ontario. Housing available. Salary open. Apply to File No. 3756-V.

JUNIOR MECHANICAL ENGINEER with industrial experience required as assistant to the plant engineer in a factory in the Montreal area. Salary about $225. Apply to File No. 3758-V.

MECHANICAL ENGINEER, preferably bilingual, with design experience required by a manufacturer in Quebec, for development of new textile machinery. Salary $350-$400. Apply to File No. 3767-V.

GRADUATE MECHANICAL ENGINEER, experienced in boiler operation, required as assistant superintendent on maintenance of railroad and tramways rolling stock, in the Quebec area. Salary $200. per month. Apply to File No. 3772-V.

MINING

MINING ENGINEER with several years experience required by a company engaged in large scale asbestos production in Quebec. Salary open. Apply to File No. 3683-V.

MINING ENGINEERS, with varied experience required by a firm in Quebec for general mine operation, exploitation and development work. Salary from $250. Apply to File No. 3743-V.

MISCELLANEOUS

MANAGEMENT ENGINEER with business administration and mechanical background, age 30 up, bilingual with at least 5 years practical experience, required by an industrial engineering consultant in Montreal. Apply to File No. 3307-V.

CIVIL OR MECHANICAL ENGINEER with experience in pulp and paper mills, to be assistant to plant engineer in a paper mill in Central Quebec. Salary open. Apply to File No. 3445-V.

TWO STRUCTURAL STEEL DRAUGHTSMEN with five or more years experience in designing and detailing steel structures. State experience and salary required. Location Toronto. Apply to File No. 3451-V.

MECHANICAL OR ELECTRICAL ENGINEER with experience in paper mill or steam plant operation, bilingual if possible, is required by an industrial firm near Montreal. Salary from $300, according to experience. Apply to File No. 3498-V.

STRUCTURAL STEEL DRAUGHTSMEN AND CHECKERS, preferably graduate engineers but any experienced men acceptable, are required for a steel fabricating company in Manitoba. Salary open. Apply to File No. 3519-V.

MECHANICAL OR MINING ENGINEER, age 30-40 with experience in industrial engineering, required by a large mining and processing firm for methods studies of equipment, labour and costs. Salary according to qualifications. Apply to File No. 3524-V.

ASSISTANT PLANT ENGINEER with paper mill experience required by a pulp and paper company with plants in Eastern Canada. Salary open. Apply to File No. 3549-V.

GRADUATE ENGINEERS with experience in air-conditioning, heating, refrigeration and allied problems, required by a manufacturer in the Montreal area. Salary open. Apply to File No. 3566-V.

DESIGN ENGINEER with considerable experience required by a pulp and paper firm in the St. Maurice Valley. Salary open. Apply to File No. 3573-V.

GRADUATE ENGINEERS, required by a large industrial and chemical organization with headquarters in Montreal for all phases of research design, operation, development, production and maintenance. Salaries open. Apply to File No. 3588-V.

ASSISTANT PROFESSORS AND INSTRUCTORS required for the staff of a technical college in New York State. Salary open. Apply to File No. 3600-V. (A)

DESIGN ENGINEERS with experience in reinforced concrete and hydraulic structures for hydro-electric developments for an engineering firm with headquarters in Toronto. Salary open. Apply to File No. 3612-V.

CHIEF ENGINEER with industrial experience required for a steel fabricating plant in Western Canada. Salary open. Apply to File No. 3616-V.

STRUCTURAL AND MECHANICAL DRAUGHTSMAN required for detail drawings by a steel fabricating plant in Western Canada. Salary open. Apply to File No. 3616-V.

SALES AND SERVICE ENGINEER with considerable experience in sales and heavy mechanical equipment required by a sales organization on the West Coast. Salary open. Apply to File No. 3626-V.

DESIGN DRAUGHTSMAN for the design of cranes and hoists of all types, capable of making and checking complete manufacturing detail drawing, required by a manufacturer in Southern Ontario. Apply to File No. 3628-V by letter with full details. Salary open.

SALES ENGINEER with wide engineering experience wanted by a company in Toronto for the sale of textile machinery and construction equipment. Salary open. Apply to File No. 3639-V.

MECHANICAL AND STRUCTURAL DESIGNERS AND DRAUGHTSMEN required by a pulp and paper company in the Port Arthur district. Salary open. Apply to File No. 3653-V.

ASSISTANT ENGINEER with experience in estimates and specifications for industrial work required by a pulp and paper company in the Port Arthur district. Salary open. Apply to File No. 3653-V.

CHIEF DRAUGHTSMAN with at least five years draughting room and related engineering office experience, preferably in pulp and paper or process industries, required by a pulp and paper mill in the Port Arthur district. Salary open. Apply to File No. 3653-V.

CIVIL OR MECHANICAL ENGINEER, required by a pulp and paper company in Newfoundland to look after new development work and general engineering in connection with woods operations. Salary open. Apply to File No. 3655-V.

ASSISTANT PLANT ENGINEER, preferably with pulp and paper or structural design experience, required for a newsprint mill in a city on north shore of Lake Superior. Salary open. Apply to File No. 3657-V.

JUNIOR ELECTRICAL OR MECHANICAL ENGINEER required by an industrial firm in Montreal for training as an industrial engineer, including plant layout and maintenance. Salary open. Apply to File No. 3660-V.

MECHANICAL OR ELECTRICAL ENGINEERS for training as production engineers with an industrial firm in Montreal. Salary open. Apply to File No. 3662-V.

CONSTRUCTION ENGINEER with ten years' experience in the design and erection of steel and concrete buildings required for the staff of an oil company in Montreal. Travelling involved. Salary open. Apply to File No. 3663-V.

JUNIOR ENGINEERS preferably with pulp and paper or other industrial experience required for training for the sales staff of a Montreal manufacturer of machines and equipment. Salary from $175. Apply to File No. 3664-V.

GRADUATE ENGINEERS for mechanical design, experimental, test and development departments of a Canadian firm producing aircraft gas turbines. Salary open. Apply to File No. 3667-V.

STRUCTURAL DESIGNERS AND DRAUGHTSMEN required by a firm of consulting engineers in Montreal. Salary open. Apply to File No. 3668-V.

JUNIOR ENGINEERS, recent graduates up, as designing draughtsmen for a brewing company with headquarters in Montreal. Salary from $200. Apply to File No. 3670-V.

SALES ENGINEER with knowledge of sawmill and woodworking equipment, preferably bilingual, required for the sale of specialized equipment. Salary $200 plus commission. Apply to File No. 3678-V.

INDUSTRIAL ENGINEER as field representative in the Toronto-Niagara area for a government department, five to ten years experience. Salary about $300. Apply to File No. 3682-V.

JUNIOR ENGINEER, recent graduate up, required as surveyor by a company engaged in large scale asbestos production in Quebec. Salary open. Apply to File No. 3683-V.

CIVIL OR MECHANICAL ENGINEER, experienced in design and field supervision of construction of industrial buildings, piping, pumping and mechanical equipment, for products distribution of major oil company. Ten years experience required. Salary open. Apply to File No. 3685-V.

STRUCTURAL STEEL CHECKER OR DRAUGHTSMAN required immediately for a steel fabricating company in Niagara Peninsula. Salary open. Apply to File No. 3687-V.

MECHANICAL OR ELECTRICAL ENGINEER with general industrial experience, preferably with knowledge of time study, required by a wire and cable manufacturing company in Ontario. Salary approximately $225, depending on qualifications. Apply to File No. 3690-V.

JUNIOR CIVIL OR MECHANICAL ENGINEERS with design or structural experience required by a manufacturer of contractors' equipment in the Hamilton area. Salary open. Apply to File No. 3698-V.

CONSTRUCTION ENGINEER with field experience, age about 30, required as office engineer and assistant to general manager for a firm of contractors in Montreal. Salary open. Apply to File No. 3703-V.

CIVIL OR MECHANICAL ENGINEER with considerable experience in the design and layout of industrial plants required for the design staff of an industrial organization in Montreal. Salary from $250. Apply to File No. 3704-V.

SPECTROSCOPIST with experience in chemical analytical work and the use of the commission spectograph required by an industrial organization with headquarters in Montreal. Salary open. Apply to File No. 3706-V.

FORESTRY ENGINEER, recent graduate up, required by a paper company for woods operations on the Lower St. Lawrence. Salary from $175. Apply to File No. 3707-V.

JUNIOR SALES ENGINEER, mechanical background, age 25-30, required by a Montreal firm manufacturing steel tanks, oil drums and other equipment for the oil industry. Salary about $200. Bilingual an advantage. Apply to File No. 3709-V.

JUNIOR ENGINEER DRAUGHTSMAN required by a Montreal firm designing and manufacturing aeroplane equipment. Salary open. Apply to File No. 3712-V.

JUNIOR ENGINEERS, recent graduate up, required for the engineering staff of a communications company with headquarters in Montreal. Veterans preferred. Salary from $175. Apply to File No. 3713-V.

JUNIOR STRUCTURAL DESIGN ENGINEER required by a steel fabricating firm in Central Ontario. Salary open. Apply to File No. 3715-V.

JUNIOR ENGINEERS, preferably with some mechanical design experience, required for the engineering staff of a manufacturer in Sherbrooke. Salary open. Apply to File No. 3721-V.

JUNIOR ENGINEERS, recent graduates up, with mechanical background required by a Montreal manufacturer for the design and supervision of boiler plant installations, preferably bilingual. May have sales work. Salary from $200. Apply to File No. 3722-V.

MINING AND METALLURGICAL ENGINEER, age about 30, with considerable experience, required by a manufacturer in the St. Maurice Valley. Salary open. Apply to File No. 3723-V.

CONSTRUCTION ENGINEER with considerable experience required for the permanent staff of a Montreal inspection company. Salary about $200. Age immaterial. Apply to File No. 3728-V.

JUNIOR ENGINEER, preferably with experience in heating and combustion problems, required by a specialist firm in Montreal. Salary $250-325. Apply to File No. 3729-V.

PLANT ENGINEER, age about 35, with factory experience and mechanical background, including maintenance and power plants, steam and electrical, required by a manufacturer in Montreal. Salary from $350. Apply to File No. 3735-V.

SALES ENGINEERS, with mechanical and electrical background, bilingual, required by a Montreal firm handling road building and contractors equipment, generators, pumps, etc. Salary open. Apply to File No. 3737-V.

DETAILER AND DESIGNER for reinforcing steel with considerable experience required by a steel fabricating firm in Montreal. Salary open. Apply to File No. 3740-V.

STRUCTURAL STEEL DETAILER AND CHECKER with considerable experience required for checking shop details by a steel fabricating firm in Montreal. Salary open. Apply to File No. 3740-V.

DESIGN ENGINEERS, age about 30, with experience in the design and layout of chemical plants, required by an industrial organization in the St. Maurice Valley. Salary from $250. Apply to File No. 3741-V.

DESIGN DRAUGHTSMEN, age about 25, with experience in chemical plant layouts, required by an industrial organization in the St. Maurice Valley. Salary from $200. Apply to File No. 3741-V.

INDUSTRIAL ENGINEER, with broad experience in plant development, operation, costs and management required for a firm in Quebec. Salary from $250. Apply to File No. 3743-V.

SALES ENGINEER required in the St. John, N.B., district by a firm handling oil purifiers, piston rings and allied engineering products. Salary $250. plus commission. Apply to File No. 3744-V.

SALES ENGINEER, preferably bilingual, required by a Montreal firm dealing in building materials. Salary from $200. Apply to File No. 3745-V.

TOWNSITE SUPERINTENDENT required for a paper company town in Western Ontario. Salary open. Apply to File No. 3747-V.

GRADUATE ENGINEERS, recent graduates up, preferably mechanical, required for the engineering and operating staff of a pulp mill in Eastern Quebec. Salary open. Apply to File No. 3748-V.

PUBLICITY ENGINEER required by an electrical firm in Montreal to organize publicity department and edit trade journal. Salary open. Apply to File No. 3751-V.

SUMMER EMPLOYMENT...WANTED

The Employment Service of the Engineering Institute is endeavouring to aid their Student members to obtain suitable practical experience during the summer months. We would appreciate any assistance from firms anticipating such openings.

GRADUATE ENGINEER, under 40, with industrial and manufacturing experience and some knowledge of sales, required by a bolt and nut manufacturer in the Montreal area. Salary open. Apply to File No. 3752-V.

GRADUATE ENGINEER required by an insurance company in Montreal for the inspection of boilers, steam plant and allied equipment. Salary from $200. Apply to File No. 3754-V.

CHIEF DRAUGHTSMAN with experience in Pulp and Paper Mill design wanted immediately in Port Arthur. Reply stating education, experience. Salary open. Apply to File No. 3760-V.

CIVIL, MECHANICAL OR CHEMICAL ENGINEERS, recent graduates up, preferably with experience in petroleum and heavy industry such as chemical or paper, required by an oil company in Toronto. Salary open. Apply to File No. 3762-V.

GRADUATE ENGINEER, with practical experience, production and maintenance, to take charge of Farm Equipment Factory with Grey Iron Foundry, located in Ontario. Apply with photo or snapshot to File No. 3764-V. Salary open.

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GRADUATE CIVIL ENGINEER, M.E.I.C., P.E.Q., 20 years work on Hydraulic Plants as designer and superintendent of construction. Extensive experience in guniting, diamond drilling and pressure grouting. One month notice. Apply to File No. 1527-W.

CIVIL ENGINEER, Jr. E.I.C., P.Eng., McGill, 30 years of age, bilingual, ex-R.C.E. officer, 3 years' experience on construction, 2 years pulp and paper industry, 1 year with public utility firm, administrative and contact ability, seeking permanent position. Available on short notice. Apply to File No. 1552-W.

INDUSTRIAL ENGINEER, C.E., B.A.Sc., M.E.I.C., age 38, married, bilingual, process development, methods, time-study, production control, job evaluation, plant layout, sales. Services available at short notice. Apply to File No. 2157-W.

GRADUATE ENGINEER, M.E.I.C., member of Board of Trade, Corporation of Professional Engineers, age 33. Interested in: Consultation, analyzing problems, constructive planning, programming projects and over-all direction. Have had real experience and responsibilities in executive planning, inspection and supervision in industry, scheduling, control, costing, promoting production, customer satisfaction, technical sales. Apply to File No. 2441-W.

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CIVIL ENGINEER, M.E.I.C., Registered Professional Civil Engineer of Ontario, Resident Engineer on large unit price projects plus wide general experience. Available on short notice. Apply to File No. 2651-W.

ELECTRICAL-MECHANICAL ENGINEER, Jr.E.I.C., age 30, graduate of Naval Electrical Engineering Officers course at Nova Scotia Technical College, 1945. Graduate of Naval Electrical Artificer's course at University of Alberta, followed by 6 months of instructional work on same. One year at sea as Chief Electrical Artificer on frigate, in charge of all electrical equipment. Completed apprenticeship as machinest in railway repair shops in design work testing, research and calculations. Available on two weeks notice. Apply to File No. 2693-W.

MECHANICAL ENGINEER, S.E.I.C., P.E.Q., Jun. A.S.M.E., McGill 1946. Age 22. Single. Experience in methods engineering, tool design, heating and ventilating. Would prefer position with an established firm with a machine shop in order to gain shop experience. Suitable position anywhere in Canada acceptable. Available on short notice. Apply to File No. 2707-W.

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ELECTRICAL ENGINEER, Jr. E.I.C., age 34, R.P.E., Ont., on University staff, with sales, maintenance and switchboard design experience. Desires summer employment. Apply to File No. 2809-W.

GRADUATE ENGINEER, mining, Jr. E.I.C., R.P.E., Ont., age 31, married. Approximately three years' experience in mine and land surveying, and three years as a supervisor in production, development and process control in heavy industry. Presently employed, but interested in a position with Consulting Engineer, Surveyor, or in Production. Location preference: Ottawa or Toronto areas. Apply to File No. 2810-W.

RECENT GRADUATE ENGINEER—(Civil, electrical, mechanical) B.Sc., S.E.I.C., would accept sales work during spare time, anywhere in Province of Quebec. Apply to File No. 2814-W.

YOUNG MECHANICAL ENGINEER, B.A.Sc. Toronto, S.E.I.C., single, now engaged in product design and development with firm in the Maritimes, would prefer similar work in Southern Ontario requiring more technical and also some artistic ability. Apply to File No. 2818-W.

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GRADUATE MECHANICAL ENGINEER, Toronto '37, M.E.I.C., P.E.Q., with 10 years experience in design, layout and production of power plant and allied equipment. Available on short notice. Montreal area preferred. Apply to File No. 2826-W.

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CONTENTS

COVER PICTURE

A veteran is still doing an honest day's work. This log dam is located on the Eagle River, a tributary of the Gatineau, in the Province of Quebec. —*National Film Board Photograph*

APPLICATION OF THE CYLINDRICAL SHELL FOR CONCRETE ROOFS

ERIC C. MOLKE
Chief Engineer, The Roberts & Schaefer Company, Chicago, Ill.

A paper presented before the Montreal Branch of The Engineering Institute of Canada on November 26th, 1945

The basic principles of cylindrical shell design are described by the author, and the application of these principles to roof and pipe designs are illustrated.

The object of this paper is to give a short review of the basic principles of the structural design of a cylindrical shell and to show, by various illustrations and comparisons, the possibilities for the application of these principles in the design of structures such as roofs and pipes.

Fundamentally, a shell is a comparatively thin plate, curved in one or in two directions and properly stiffened against undue deformation at the edges. A three dimensional structure of this type constitutes one of the oldest forms of building construction, the dome.

The principle of stiffening the edges of a shell has been used for ages in shaping glass and earthenware. Lately, it is being used particularly in the sheet metal industry on the edges of thin curved sheets to form automobile fenders and bodies, aeroplane wings and fuselages and many other items used in our everyday lives. Considering that the strength and stiffness of such small objects is due to the high carrying capacity of shell construction, it is logical that the use of these principles should be extended to the construction of large roof structures. Such application necessitates, however, a deeper understanding of the problem of stress distribution in a shell and, therefore, in the following we will develop the conceptions of the three dimensional shell action from the conventional beam slab design.

Straight Line Distribution of Stresses

In the solution of ordinary design problems, it is customary to base our calculations on the straight line distribution of stresses in a cross section. Our standard beam formulas gave satisfactory results if the proportion of depth to span is small. However, the distribution of stresses in a high wall supported on columns requires a different approach. This problem occurs repeatedly in shell structures and is to be considered the first principle of structural shell design.

Referring to the diagrams, Fig. 1 shows the distribution of principal stresses in a high beam wall continuously supported over several spans. Full lines indicate the direction of compressive stresses and dotted lines the direction of tensile stresses. Stresses change in magnitude along the trajectories. The diagram in the centre of the span and also the one at the right edge show the stress distribution in vertical cross sections at the respective positions and present a comparison of magnitudes.

Figure 1(a) is calculated with the usual assumption of a straight line distribution of stresses while Fig. 1(b) is calculated with the use of more exact stress theories. It can be seen that the main bridging action, that is the guiding of the load into the columns, takes place near the lower edge. The upper part in a high beam acts merely as a column carrying the load downwards. By comparing the stress diagram in Fig. 1(a) with 1(b) one can see how dangerous it would be to apply the assumption of a straight line distribution of stress to high diaphragm structures.

To continue, it will be helpful to visualize a simple three dimensional structural member which can be developed from a plane diaphragm by rolling it

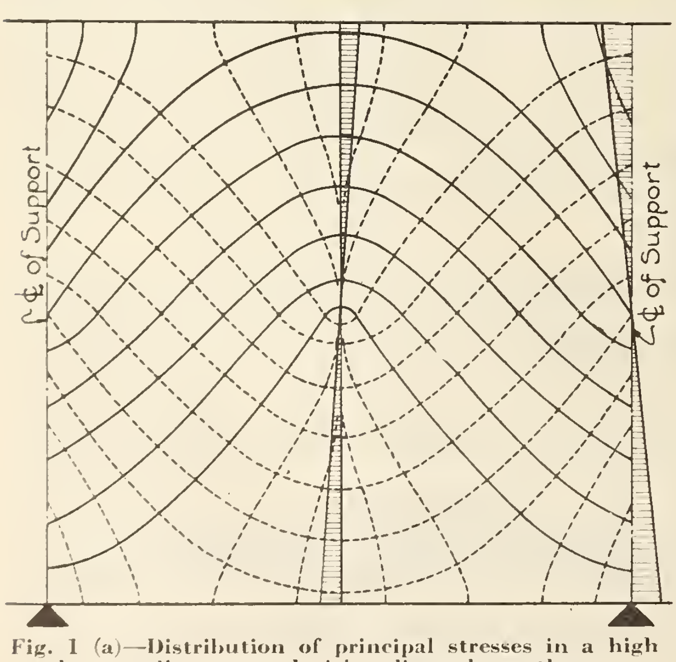


Fig. 1 (a)—Distribution of principal stresses in a high beam wall; computed with ordinary beam theory.

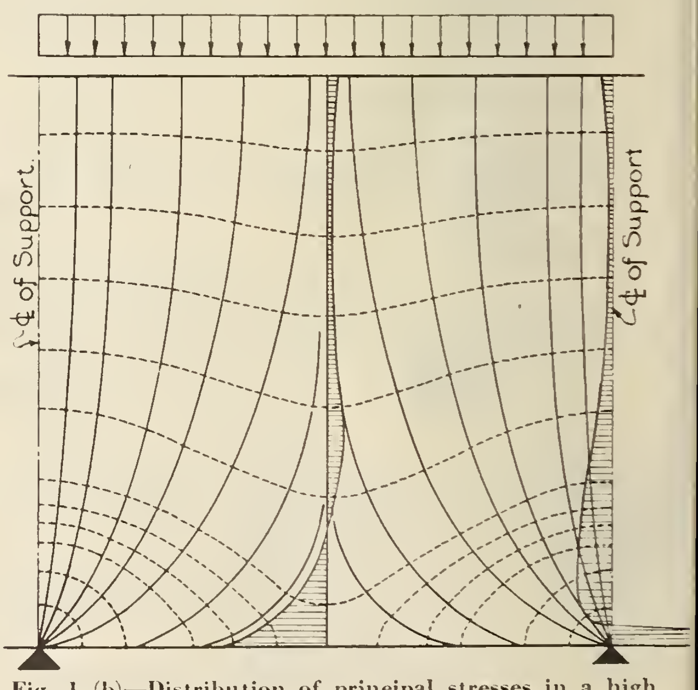


Fig. 1 (b)—Distribution of principal stresses in a high beam wall; computed with stress functions.

around a cylinder and joining the top and bottom edges of the diaphragm, thus forming a continuous pipe surface. The simple column supports in the case of the plane diaphragm must be replaced by ring girders supporting this pipe shell continuously around the surface.

Diaphragms offer great resistance to loads acting in their plane and, likewise, the pipe shell has great resistance to loads which can be transferred by a set of direct "membrane" forces, over the material of the shell, to the supports.

Figure 2a illustrates the lines of principal stresses due to dead load over a full pipe shell. It is assumed that the pipe is supported at each end by stiff frames all along the periphery. To obtain a better understanding of the stress lines one could imagine the pipe to consist of a flexible membrane like an umbrella and supported by bar ribs shaped to the solid lines representing compression and suspended by ropes strung along the dotted lines which are representing tension.

The forces acting on the stiffener ring, also called end frame, are the resultant components of the principal stresses in the connecting pipe shell. Since the principal stresses act along the membrane of the pipe, these resulting forces act tangential to the surface of the pipe at this location, as can be judged from the stress trajectories.

Observing these stress lines in Fig. 2a, one can easily understand how the membrane of a shell will be able to carry great loads by merely tensile and compressive forces acting along the material of the membrane. Visualizing this stress action along the end frame, one can sense a discontinuity in the deformation near the supports where the heavy stiffener rings do not permit a free adjustment of the strains resulting from the membrane stresses. It is therefore apparent that some longitudinal bending moment will occur in a zone adjacent to the stiffener rings, which is called "rim bending". It will always be necessary to reinforce the shell in this "rim zone" to resist the flexural stresses.

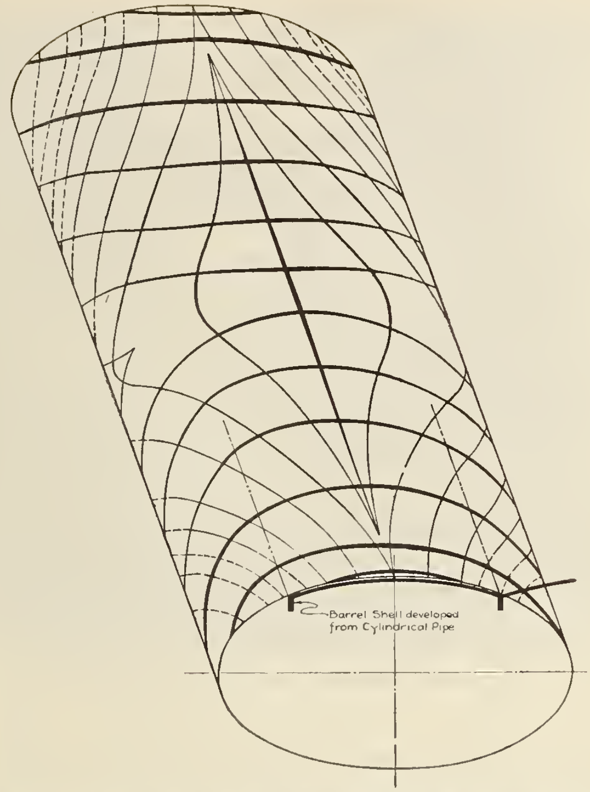


Fig. 2 (a)—Illustrates the lines of principal stresses due to dead load over a full pipe shell. The barrel shell consists of a part of such a cylindrical pipe.

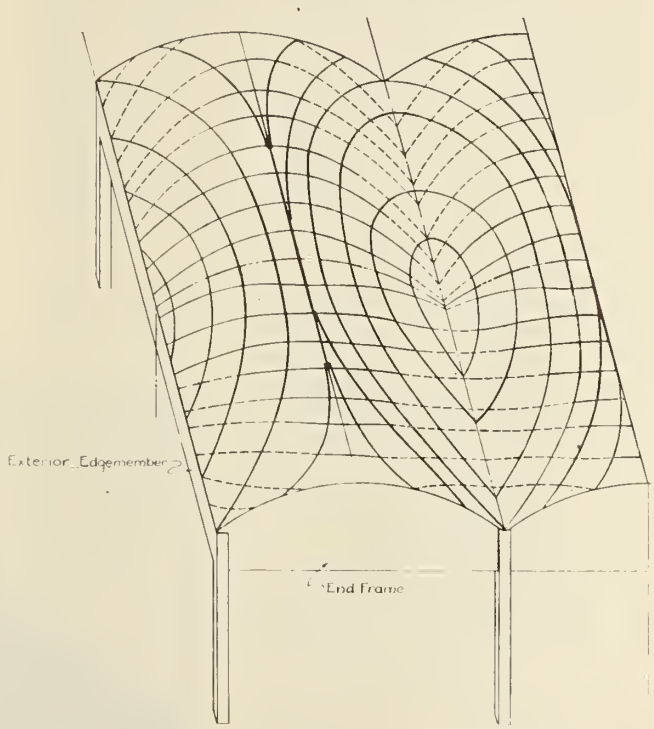


Fig. 2 (b)—Illustrates the lines of principal stresses on a multiple barrel roof. Note the dome action by which the load is carried towards the columns.

Application to Large Roof Spans

It is logical that part of such strong lightweight structural members should also be applied for the economical construction of roofs of large span. A barrel shell roof is made up of such building units. It consists of a part of a pipe stiffened at the edges by edge members and end frames as indicated in Fig. 2b. In cutting off the lower portion of the pipe and substituting edge members of considerably less stiffness than the detached part of the pipe, it is logical that a certain change in the stress distribution has to take place. The edge member cut loose from the shell could deform if acted upon by the original shell stresses. A gap, of course, cannot exist and therefore the stresses along the edge must be smaller, and as a consequence the excess has to be absorbed by the shell itself. The resultant stress lines are shown in Fig. 2b.

Figure 3, an isometric view, shows distribution of principal stresses or trajectories over one concrete shell unit of the Hershey, Pa., sports arena, which was the first shell structure of large span built in the United States.

The two hinged arch ribs are spaced 39 ft. 2 in. on centres, and have a theoretical span of 222 ft. The shell slab is 3½ in. thick of elliptical shape, having a radius of 132 ft. over the larger portion, and a minimum radius of 42 ft. over a narrow zone along the edge members. The slab spans between two arch ribs and cantilevers beyond each 19 ft. 7 in.

The trajectories in the vicinity of the edge member show a striking resemblance to the lines of principal stresses for a diaphragm with load applied on the top edge such as has been illustrated in Fig. 1b. As

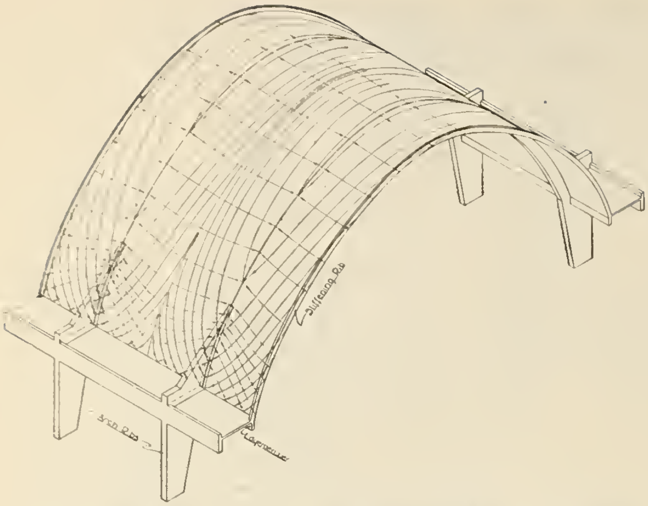


Fig. 3—Isometric view of principal stresses over a barrel shell carried on arches. Note how edge member is hung to the arches. The dotted lines represent direct tensile stresses in the shell. The solid lines represent direct compression stresses.

a matter of fact, the lower part of the shell acts exactly like such a diaphragm wall, bridging the arch forces of the shell towards the supporting arch legs. Consequently a shell structure can also be compared with a full tunnel arch on which the continuous support along the bases has been substituted by point supports at intervals.

It is not the small edge member at the base of the arch which is acting as a bridge, but the lower part of the shell. In fact, edge members are so weak on many shell structures that they are not even able to carry their own dead load and the adjoining shell has to carry them with diaphragm action. The edge member acts merely to perform a function similarly as the tension chord on a truss, stiffening at the same time the edge of the thin shell. The bridging action extends only over the lower part of the shell. In the example illustrated, the acting diaphragm is about 25 ft. high which is two-thirds of the span.

Characteristic of barrel shell roofs besides these point supports along the bases, is also that they have stiffening arches at these supports which, on account of their stiffness, draw to themselves and concentrate all the moment actions inherent in tunnel arches. This makes it possible to use a thin shell stretched between the arches similar to the skin of an umbrella held between the stiff spokes.

In an umbrella, an ordinary tent or in water tanks, which are all thin shell structures commonly used, the skin taking the load is principally under tension. In a cylindrical roof most of the skin forming the surface is under compression. This makes concrete the logical material for such construction. Steel plates used for a cylindrical roof would be too thin to withstand such compressive action without buckling ribs. Even with concrete roofs, the shell, which is usually about three inches thick, has to be specially investigated for buckling and proper curvature and sometimes buckling ribs have to be provided as stiffeners. Compressive stresses in general are, however, low and amount to only about 200 to 300 lb. per sq. in. of concrete.

On account of secondary bending moments and shrinkage actions, a layer of light reinforcing steel or welded wire fabric is usually provided in the top and bottom of a concrete shell. These top and bottom layers form a rectangular pattern in a horizontal and arch direction. Additional bars are placed diagonally near the middle of the shell only along the tensile stress trajectories (the dotted lines in Figs. 2b and 3). Depending upon the span of the shell in both the transverse and longitudinal directions, as well as the curvature, location of live loads, openings, etc., it may be necessary to place additional moment bars at the points where such factors produce forces similar to "rim bending" previously described.

Where it is desired to provide openings in shell roofs, the stress trajectories simply adjust themselves and the shell bridges the opening. Expansion joints are usually placed midway between alternate supporting arch ribs, so that the building is divided into independent structural units composed of a shell and two supporting arch ribs with the shell cantilevering beyond the arches for half the distance between ribs.

Construction Not More Complicated Nor Expensive

Concrete for large shell slabs is no more difficult to place and finish than with ordinary slab construction. The shell is the steepest at the springing line, but, even there, top forms in general are not necessary as long as the slope does not exceed 45 deg. It has been found that a tightly wired mesh of reinforcing bars is able to keep the comparatively thin layer of wet concrete from sliding.

Since supporting ribs on American shell structures have been usually placed above the shell, an unobstructed underside has been obtained permitting the use of travelling formwork. Formwork travellers are usually built the full width of the transverse span and the length of a standard construction unit, generally about 80 ft. from expansion joint to expansion joint. The shell reinforcing is placed on the traveller centering, rib forms are set up around the arch rib reinforcing

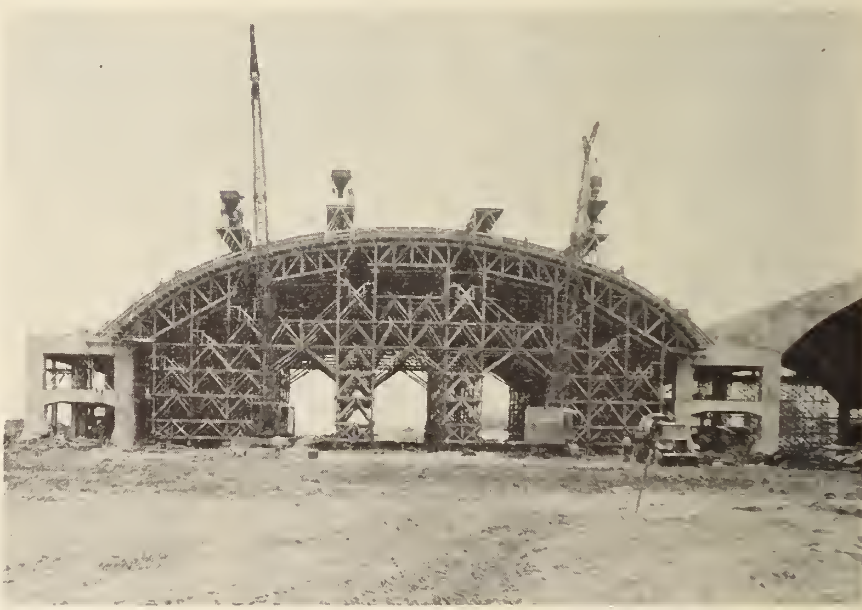


Fig. 4—Twin hangar built for U.S. Navy. Formwork and arrangement of runways.

and concrete is then placed.

In the forms the concrete is spaded to a rough grade about one-half inch above the final thickness of the shell. The slump of this approximate 1:2:3 concrete varies from 1 to 4 in., depending entirely on the slope of the section. This low slump makes it possible to place the concrete without top forms, even on quite steep slopes. The concrete is screeded off by a straight edge to the screed strips, and the strips removed. After it has hardened slightly the surface is floated with a wood float or darby and then the concrete is covered and thoroughly cured by keeping it wet for a period of at least seven days. After two days the concrete usually obtains sufficient strength so that the forms are lowered a few inches by means of screw jacks or wedges and are then rolled ahead to the next unit, and the operation is repeated.

Fig. 5—Interior view of the Engineering Shops Building at Wright Field, Ohio.

Strength and elastic properties of the thin slabs are excellent. The average cylinder strength obtained is about 4,000 lb. per sq. in. and the modulus of elasticity 3,000,000 lb. per sq. in. after 28 days. Since the average stress in a shell roof does not amount to more than 300 to 400 lb. per sq. in., safety beyond that required by standard codes is obtained. After the shell roof is finished it is covered with a two-ply built-up roofing.

Actual construction has proved that the placing of reinforcing in this shell is no more expensive than for standard reinforced concrete structures. Of course it must be remembered that approximately 40 to 50 percent of the bars entering a shell structure are of small diameter, and accordingly the unit price will be higher on a tonnage basis but not higher than in any structure where small bars are used. Placing and supporting of bars need not be done more accurately than general practice demands. Doubly curved diagonal bars in the shell slab are furnished straight and when tied at the required spacing, they tend to curve properly by their own weight. A close spacing of small bars has distinct advantages as it is more effective against volume change of the concrete and increases the fireproofness by reducing the tendency of the concrete to spall over larger bars.

For buildings which are regular in shape, particularly those of long rectangular plan, and for equal conditions of load and span, reinforced concrete shell structures will require fewer pounds of steel per square foot of covered area than structural steel buildings with wood decks, and less wood than wooden buildings. On a dollar basis, shell structures will often be less expensive than, and in most cases will be competitive. with other types of structures.

Fire Hazards Minimized

The fire safety of the shell roofs was vividly illustrated on a recent job where, under cold weather conditions, the roof concrete was being kept warm by salamanders underneath the shell forms. The concrete had " set " but its strength was rather low (1,500 lb. per sq. in.) when the formwork caught fire from overheated salamanders and, under the drive of a high wind, was completely burned out in less than two hours. When the fire had cooled and an examination could be made, it was found that the damage was minor, consisting of some spalling and minor cracking of the shell, but it was decided that load tests should be made prior to any repair work. This was done, and it was found that no serious decrease of load carrying capacity had been caused by the fire. All that was necessary to repair the building was to " gunite " over the areas where the concrete had spalled.

Figure 4 illustrates one of the twin hangars built for an eastern U.S. Naval Base. The clear span of these hangars is 160 ft. Note the simplicity of the form centering and the arrangement of runways for pouring concrete. Figure 5 is an interior view of the Engineering Shops Building at Wright Field, Ohio. This building is 362 ft. by 421 ft. and consists of nine 40-ft. barrels spanning 56 ft. between columns. Note the monorails suspended from the shell slab and the percentage of roof area taken by skylights.

The development of the modern design and the economical methods of construction of thin shell concrete barrel shaped roofs is the result of many years experience in design, supervision of construction, continuous research work and tests of various structures during and after construction.

At the present, an ice arena at Victoria, B.C., is being built, using the principles of the cylindrical thin shell, under the direction of Mr. C. T. Hamilton. Earlier the theory of the cylindrical shell has been applied in Canada on the pipeline for the Ontario Paper Co.'s Outardes development on the Lower St. Lawrence, and was described in *The Engineering Journal*, April 1938.

THE SMOKE PROBLEM

E. A. ALLCUT, M.E.I.C.
Professor of Mechanical Engineering, University of Toronto.

A paper presented before the Toronto Branch of The Engineering Institute of Canada on November 28th, 1946.

The author defines the term "smoke", and shows where smoke comes from and where it goes, what causes it and what are its consequences. He also discusses how smoke is measured, what remedies are available and what organization is required to enforce such remedies. A bibliography is added.

This paper was originally intended to deal with "Toronto's Smoke Problem", but, after consideration, it became evident that the general nature of the smoke problem was common to all densely populated areas, save for a few matters of detail. It follows, therefore, that a general discussion of the smoke problem is more appropriate, and that principles only should be discussed, as the details concerned are too numerous and depend largely on local circumstances. The following considerations, therefore, will deal with the nature of smoke, its origin, disposal, causes and effects; its prevalence, methods of measurement and the remedial measures available.

What is smoke?

This question is not a purely rhetorical one, as a good deal of uncertainty exists regarding the nature of smoke and its components. All smoke is considered to be a nuisance, but the extent of the nuisance at any given time or place, depends less on the general characteristics of the smoke emitted than on certain factors or components which cause trouble in that particular area. Until the nature of the nuisance is defined, it is obviously impossible to take appropriate measures for dealing with it. The Oxford Dictionary defines smoke as "the volatile products of combustion, especially visible vapour with carbon, etc., in suspension, emitted by burning substance". This is a very general definition, and perhaps that given by Baltzer[15] is a little more appropriate, namely, "any *dirt forming* or *harmful* substance, visible or not, issuing from a *chimney*". The important words in this definition have been italicized, and thus the whole question resolves itself into a consideration of the nature and degree of atmospheric pollution resulting from the products of combustion. In the popular mind, smoke is frequently associated with the amount of haze or loss of visibility, which reduces the radius of vision. But this idea makes no allowance for dull or hazy days caused by other circumstances, or for night periods when visibility is always extremely limited. Indeed, when soot blowing or filter cleaning is performed at night, as it frequently is, the resulting local nuisance may be very great even though, at that time, nothing is visible.

Smoke usually includes four principal constituents, namely, (1) *Soot*, which consists of solid carbon particles, frequently associated with tarry matter. (2) *Combustible gases* or fumes. (3) *Ash* or non-combustible matter, which escapes from the furnace with the gases. (4) *Sulphurous gases* and other chemical agents, which are of a corrosive nature. (In some instances ammonia is also important.) The solid particles may be divided into two classes, namely, grit, which is large enough and heavy enough to be deposited in collecting vessels, and smoke proper, consisting of smaller particles which may remain suspended in the atmosphere almost indefinitely. It has been stated that, if the particles are larger than 10 microns in diameter $(\frac{1}{2500}$ in.) they are unlikely to remain suspended in moderate air currents,[25] and the larger and heavier they are, the shorter will be the distance travelled from the chimney in question. Professor Ter Linden[5] made a detailed study of this question in Holland and found that 100-ft. chimneys in Delft were emitting 50 tons of coarse grit per annum, giving rise to considerable local complaints. On the other hand, at Velsen, where the chimney was 230 ft. high, there was an emission of from 500 to 1000 tons of fine grit per annum and no complaints were received, because the grit was of a smaller size and was deposited over a wider area. (Fig. 1) He also stated that, while there is little or no visible smoke from anthracite and other similar fuels, the quantity of grit (over 50 microns) carried away may be very considerable, and detrimental to the surrounding district.

Table 1 gives the approximate composition of deposited material from domestic and factory chimneys, as obtained by various authorities in the United States and Great Britain.

Table I

Composition of Deposited Material from Chimneys

	General		
	Domestic Origin	*Factory Chimney*	*Toronto 1933*
Carbon	55–37%	48–27%	31–46%
Tar	37–40%	about 1%	below 1%
Ash	7–5%	51–62%	50–68%

In a parallel column there is an approximate analysis of the deposits collected in various parts of Toronto by the School of Hygiene, University of Toronto.[17] This would seem to indicate that the smoke in Toronto at that time was mostly of industrial origin but, on the other hand, the domestic fuels mostly used at that time were relatively free from volatile matter and the smoke obtained from them would contain very little tar. A similar survey made at the present time might produce a very different result.

The small particles, which remain indefinitely in suspension as smoke, are usually less than 1 micron in diameter $(\frac{1}{25000}$ in.) and may be as small as 1/10 micron $(\frac{1}{250,000}$ in.). This fact, which has been verified by different authorities,[5][6] indicates the extreme difficulty of isolating such particles on a large scale by filtration or other similar methods. (Fig. 3). There is a tendency for these particles to become larger in foggy weather by aggregation or by other means. The solid particles of carbon, which constitute black smoke, seldom account for more than one per cent of the combustible loss, but they are usually accompanied by combustible gases which involve serious losses of heat. Carbon burned to carbon monoxide produces only about one third of the total heat that would otherwise be available, and the volatile hydrocarbons which are invisible, produce additional heat losses. Black smoke, therefore, is usually an indicator of bad combustion conditions, which should be corrected wherever possible. Sulphur, when burned, produces SO_2 and SO_3 which, in the presence

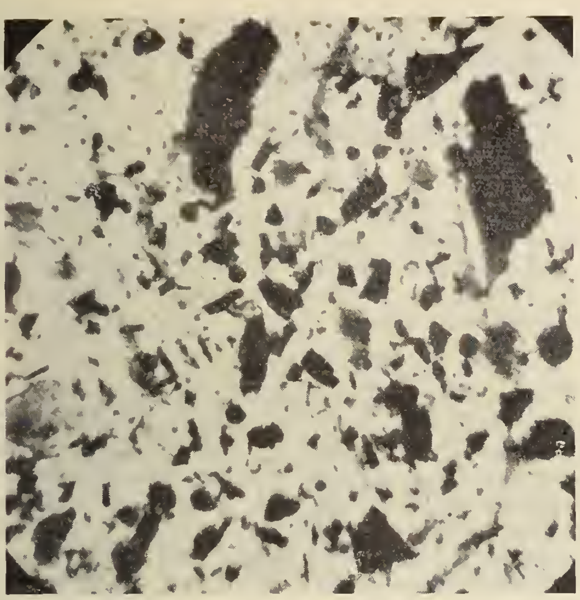


Fig. 1 (a)

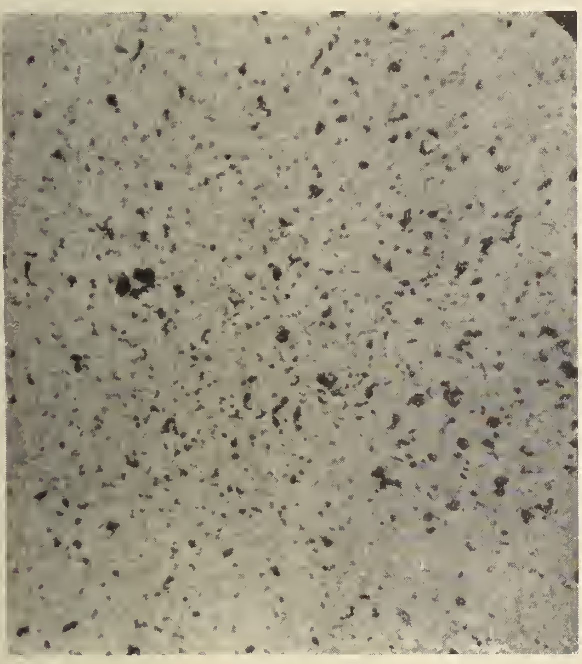


Fig. 1 (b)

of water, produce sulphurous and sulphuric acids, both of which are corrosive. One per cent of sulphur, in the fuel, which is by no means unusual, is capable of producing about 60 lb. of sulphuric acid per ton of coal.

Smoke, particularly the finer particles, becomes diffused after mixing with the atmosphere. Maclaurin[6] states that at the chimneys there are about 10,000 times as many particles per cubic foot as there are after dilution by the atmosphere, and therefore, that the right place to collect them is at the source. At Leicester[5] the following amounts of diffusion were estimated in the direction of the prevailing wind;

At chimney 118 grains per cubic yard (approx.)
20 ft. down wind (2 sec. later) 2.5 grains
100 ft. down wind (10 sec. later) 0.5 grains
4 miles down wind (30 min. later) $\frac{1}{840,000}$ grains

Smoke, however, is not always black; fly ash from pulverized coal installations, smokes from incinerators and from metallurgical furnaces are frequently of a light yellowish grey colour, and this nullifies methods of measurement that are based on colour and density. Meller[11] states that a survey in Chicago indicated that 40 per cent of the deposits collected were from sources other than fuel.

Where does smoke come from?

It is evident that any remedy to be applied at the source depends on the identification of that source. To a limited extent, the distribution tends to follow the direction of the prevailing wind, but local distribution is obviously dependent on the proximity of local sources of contamination and upon eddies or local air currents. It is advisable, therefore, to have a large number of observing stations, the locations of which are carefully chosen to avoid local disturbances. In a recent survey made at Leicester[5], fifteen observing stations were employed. Grit may be collected in deposit gauges of standard construction (about 12 in. dia.) which are uncovered when the wind is in the worst direction. In some instances, directional deposit gauges have been used satisfactorily, but some observers do not consider these to be good.[2] Cross checks may be made in different places and the direction from which the grit comes may be established reasonably well in this way. For the suspended matter, automatic filters may be employed (Fig. 8), and in some instances, the times at which successive samples are taken are also indicated automatically. This information may be correlated with the direction of the prevailing wind at those times. The Stevens Institute, in Hoboken, New Jersey,[13] plotted observations of this kind against wind direction and corrected each reading for the velocity of the wind, producing a component unit called shade-miles per hour. This was observed at two points. and when these figures were plotted, they assumed an oval form in which the long axis in each case was directed toward the same point, which included the large railway freight yards in Jersey City (Fig. 5). When appropriate action was taken there, it was recorded that the amount of smoke was reduced by 30-40 per cent. In the Leicester survey, where more observation points were used, lines of equal smoke density were plotted (Fig. 4). This procedure indicated not only the point of maximum smoke density, but also the relatively minor effect of the wind. It was found that the contours moved down wind for distances up to 1 mile and that

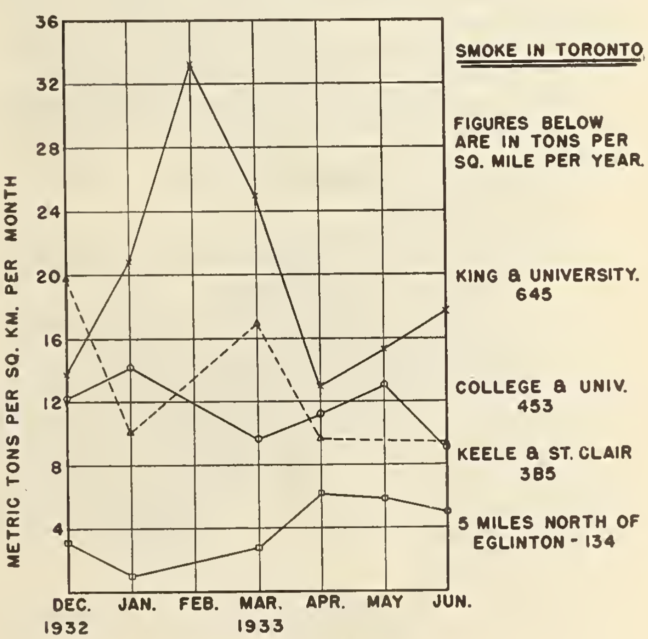


Fig. 2

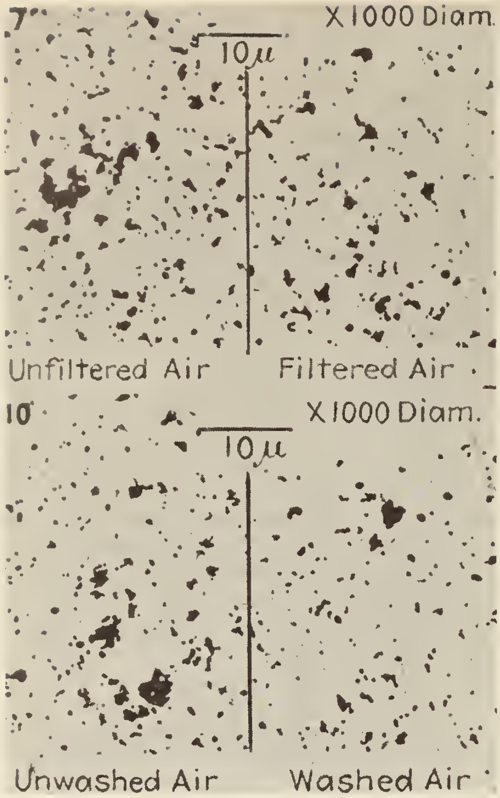


Fig. 3

the point of maximum concentration was never more than half a mile from the centre of the city.

The average conditions observed are given in Table II, which indicates that there was very little difference in the form of the contours in summer and winter respectively, the distribution being similar in both cases.

Table II—*Total Solids Deposited from Chimneys*

Distance from centre, miles	0	1	1¾	2¾
Summer—Tons per annum	241	170	146	91
Winter—Tons per annum	296	146	116	62

It was observed also that on Sundays and holidays, the smoke concentrations were from 20-50 per cent less than on week days. The causes of the daily smoke variations are shown in the diagram in Fig. 6, which has been redrawn from the original report. It was found moreover that the curve for the concentrations of sulphur dioxide was similar to that for smoke.

Owens② suggested that the source of pollution might be identified by one or a combination of the following methods:

(1) Nature of the deposit
(2) Tar content.
(3) Chemical composition.
(4) The addition of identifiable dust to the gases at the suspected source.
(5) The sizes of the particles, which give some idea of the distance from the source.

In addition to local pollution, the diagram indicates that there is some general pollution, since air can travel as much as 6,000 miles in six days, carrying fine smoke particles with it. The usual distance travelled however is from 500 to 2,000 miles. The smoke of a city generally increases with the population, and the following formula was found to express the most usual conditions.⑤

$$\text{W.M.S.} \times 10^4 = \sqrt{\text{Population}} \times (7 \pm 1)$$

(W.M.S. = Winter Mean Smoke in milligrams per cubic metre)

A further point is that, in calm weather the daily smoke carried may be from one-half to five times its normal concentration, and the SO_2 from 0.6 to 3.2 times the normal concentration. This is due to variations in turbulence, which forms an important variable factor at such times.

The extent of general pollution may be estimated from areas in which no smoke is normally emitted, but this is necessarily an approximate figure. In general, it is suggested that a proper smoke survey is not a short term proposition, but should occupy a period of not less than three to five years.

Where does the smoke go?

It has already been noted that small light particles remain in suspension for a long time, and therefore there must be some natural means of removing them. At normal times they are dissipated by the effects of wind, rain and turbulence or vertical air currents. It has also been remarked that the effect of wind is comparatively small and rain is only partly effective. Most of the removable impurities are taken out by the early part of the rain, but a good deal still remains after the initial washing. In the Leicester survey, it was found that the most effective factor in reducing pollution near the ground was vertical turbulence, as the concentration near the ground was similar in heavy or light winds. In the former case, there was less time for the particles to escape in an upward direction. The degree of such vertical turbulence varies with different meteorological conditions, and therefore any comprehensive survey should include investigations at different levels. This, however, would be both difficult and expensive.

What causes smoke?

Where fuel is the source of smoke, there are three principal factors concerned, namely, plant design, plant operation, and the characteristics of the fuel

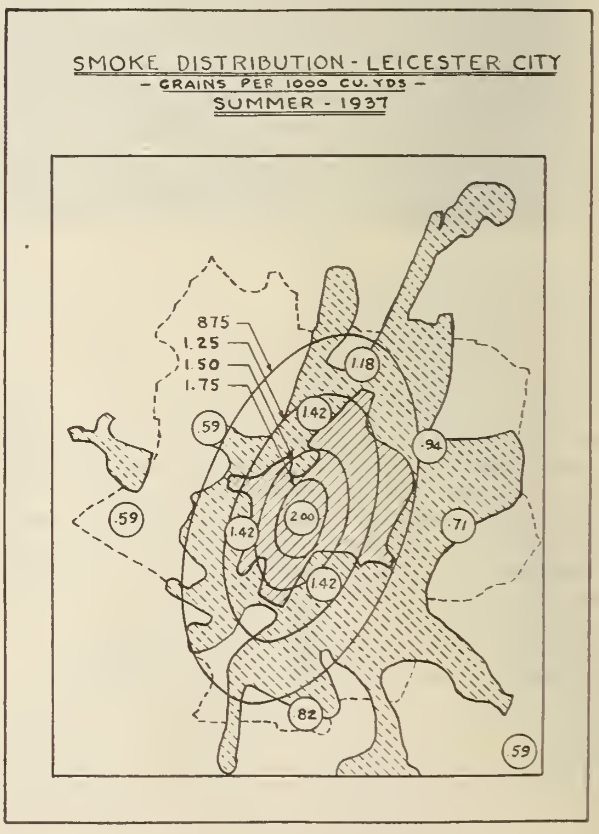


Fig. 4

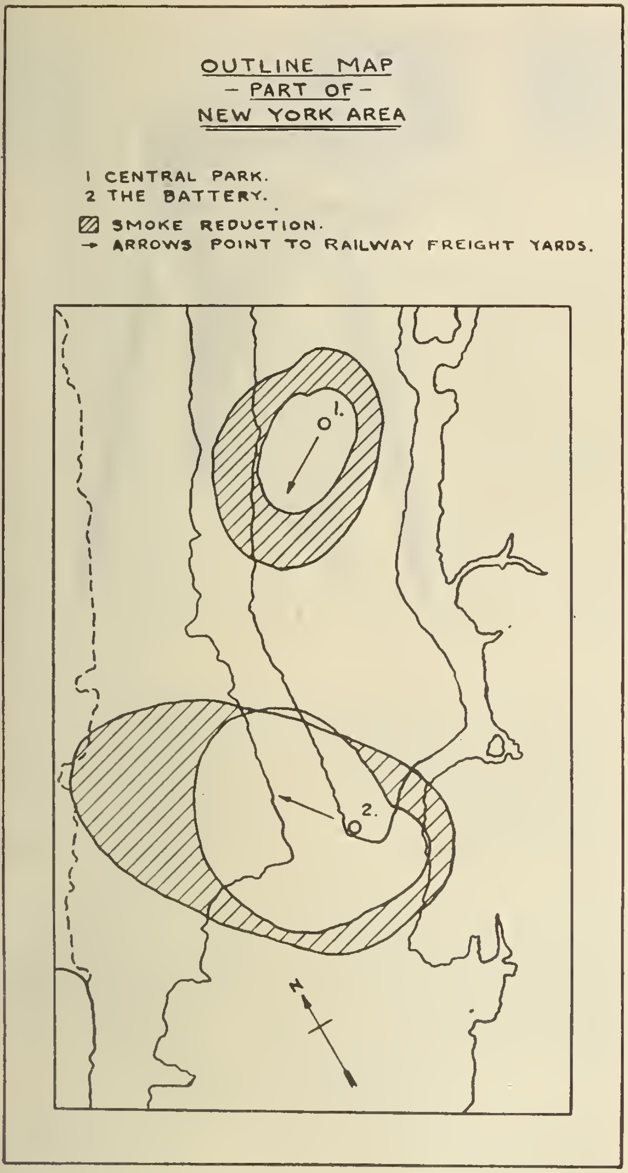


Fig. 5

supply. Firstly, the plant must be designed to enable complete combustion to be obtained under normal operating conditions. This requires that the fuel shall be raised to its self-ignition temperature and kept there for the time required for complete combustion, before it is allowed to cool. For this purpose, sufficient space must be available in the combustion chamber, and suitable draft must be provided with the proper degree of turbulence to enable the air and fuel to mix thoroughly within the time and space provided. If, therefore, the furnace is too small, or of the wrong shape, or if the cooling (heating) surfaces are too near the grate, incomplete combustion is likely to result.

Sufficient air passage areas or air pressures, or both, must be available to overcome any frictional resistances that oppose the air supply or the passage of the gas past the tubes or through the flues. Poor baffling, or the lack of an arch to preheat the coal and to mix fuel and air effectively, are also important factors. In an oil furnace, because of the volatile characteristics of the oil, larger combustion chambers of the correct shape must be provided than those necessary for coal. Lack of sufficient preheating may also contribute to incomplete combustion.

Secondly, the method of firing, which may be poor or irregular, the habit of breaking a fire to counteract coking (or caking) effects while leaving the fan running, and also that of blanketing the fire by heavy stoking, are contributory factors. If the furnace is too cool, or if an excessive load is put on the boiler, this may also produce incomplete combustion. Poor draft control and the improper use of secondary air supply above the fire may produce smoke. The boiler passages should be kept reasonably clean since, if they are clogged or dirty, the free area, which should normally be sufficient for its intended purpose, becomes too small.

Thirdly, the nature of the fuel, and more particularly the percentage of volatile matter present, is very important. Combustion can only occur on the surfaces of fuel particles, and as a rule, the hydrogen is burned in preference to the carbon. The latter assumes the form of soot, in which condition it is very difficult to burn. Much smoke is being produced at this time by the unavoidable use of fuels in furnaces that were designed for different types of fuel than those now available.

What are the consequences of smoke ?

These may be divided into human and material consequences. It has been estimated that the average human being consumes per day about 2.7 lb. of food, 4.5 lb. of water and 30 lb. of air. Other authorities suggest that the weight of the air consumed is from six to seven times that of the solid and liquid matter and yet, while we are very careful about the quality of the food and water consumed, we take very little care about the contamination of the air. It was found in St. Louis[4] that a decrease in smoke caused corresponding decreases in nose and throat ailments and of eye infections. The Leicester survey[5] indicated that smoke reduced the ultra violet light in winter by 30 per cent. Reduced visibility due to darkening windows or skylights may result in the absorption of 50 per cent of the light that would otherwise be received from outside.

Smoke also produces a greater tendency to form fog, as the water condenses on the smoke particles as nuclei, and tends to settle at lower levels for longer periods.[10] In materials, plant life is affected by poisonous soot, which also tends to clog the pores. In boilers, surface conductivity may be reduced by 25 per cent or more by fairly thin layers of soot, because the latter tends

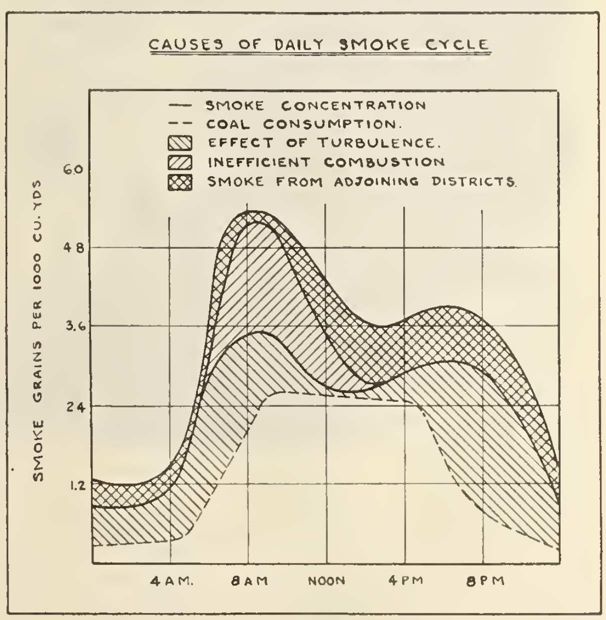


Fig. 6

to collect in fluffy forms containing considerable amounts of gas, (Fig. 7) the whole structure having very bad heat conductivity. Stone is soiled by soot and the presence of tar makes the carbon very adherent. Sulphuric acid tends to corrode stone and metal and disintegrates mortar. Copper is corroded in the presence of hydrogen sulphide. Smoke damages and soils fabrics and increases laundry costs. Paint and wallpaper also deteriorate, increasing the cost of interior decoration. In general, exposed metal must be painted about twice as often in a smoky city as in a clean one.

The cost of all this is difficult to estimate, because much of the cost is indirect, but such estimates vary from $20 per head per annum at Pittsburgh (1912) to $5 per head per annum in England (1918-22). In general, the cost is found to be roughly proportional to the amount of solid matter present.

How prevalent is smoke?

Table III indicates the mean average amounts of deposited matter in various locations, as indicated by various authorities at different times. They are given in short tons per square mile per annum, and the last two figures relate to the range of a survey made in Great Britain, where one station in London gave the smallest value and one station in Liverpool the largest. The quantities obtained in Toronto are given in Fig. 2.

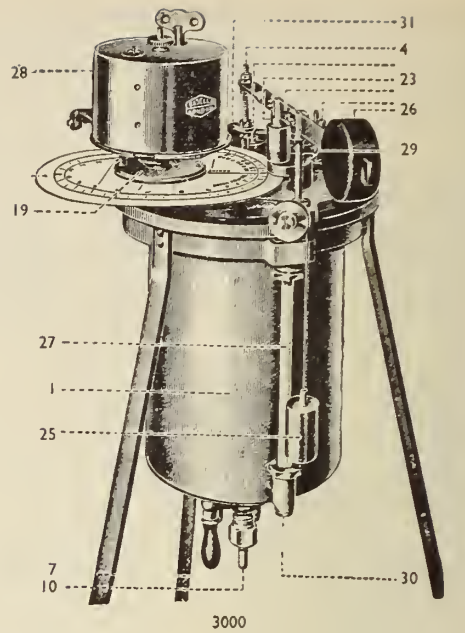
Table III

Mean Average Amounts of Deposited Matter in Various Cities.

Leicester (centre) 1945	280–330	short tons/sq. mile/annum
Toronto (city) 1933	380–650	
Toronto (country)	134	
Pittsburgh 1923-4	1304	
1912-13	937	
Duisberg (Germany)	1200	
London (minimum)	328	
Liverpool (maximum)	783	

Fig. 7

Maclaurin estimates that suspended solids in the form of small particles are worse than deposited matter, being generally of the order of 49,000 to 163,000 particles per cubic inch. Meller found that in clear weather there were from 65,000 to 81,000 particles per



References to numbers in figure

1. Vessel	25. Weight
4. Adjustable Connecting Rod	26 Manometer Cock
7. Water Inlet	27. Gauge Glass
10. Water Outlet	28. Clock
19. Turntable	29. Air Inlet
23. Air Inlet Plug	30. Plug for fixing Gauge Glass

Fig. 8

cubic inch in London air, but that in fog it might rise to 1,300,000 or 1,600,000. Even high above the street the air is not clean, as it was found in New York that the air seventeen storeys above the street contained about 18,000 dust particles per cubic inch.[25]

How is smoke measured?

There are various ways of measuring smoke, but that adopted depends on its objective. If it is required for the purpose of reducing the smoke emitted, the indicator or recorder will be placed inside the plant and there will be ready access to the chimney; on the other hand, if it is to be used as a basis for prosecution, the readings must be taken from some convenient position outside.

In the case of a smoke survey, the instruments are of a precise scientific character.[1][5] The principal ones are the deposit gauge, the ultra-violet integrator, and the smoke filter, which may be either of the visual or photometric type. In the last type, the stain on white filter paper is compared with samples (divided into ten shades), or with the density of stain as measured by a photometer. In either case, the standard used for comparison is previously calibrated by weight. The thermal precipitator (Fig. 9) consists of a hot wire,

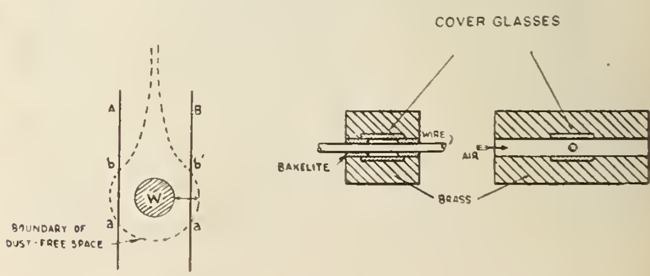


Fig. 9—W indicates position of hot wire.

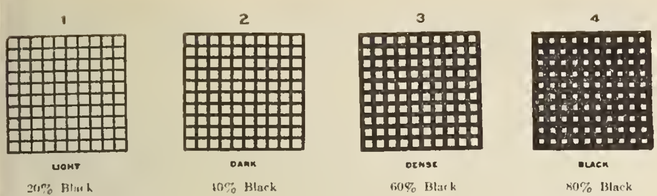


Fig. 10

past which the dust and gases are caused to flow. The solid particles are repelled from the hot wire and are collected on glass slides, upon which the dust is counted microscopically. A sulphur dioxide indicator of an approved design is also frequently employed.[5]

For internal control, continuous samples may be taken from the chimney, but correct sampling is a matter of some difficulty owing to the uneven distribution of velocity and smoke particles across the diameter of the chimney.[8] Great care must, therefore, be taken to have sampling tubes of the right proportions and in the correct positions. In most instances a beam of light is passed through the smoke column and the indication depends either on the amount of light obstructed or on the diffraction of light beams by the solid particles.

With regard to smoke inspection and law enforcement, the method and apparatus employed must be inconspicuous, simple, portable and usable at a distance and at a point considerably below the top of the chimney. The Ringelmann chart (Fig. 10) consists of a series of white cards with black lines which occupy successively 20, 40, 60, and 80 per cent of the area. When held at 50 ft. from the eye of the observer, these cards appear as varying shades of grey and are compared with the colour of the smoke issuing from the stack. The appearance of the smoke column, however, is affected considerably by its diameter, (Fig. 11) by the background (clear or dark sky), and by the colour of the smoke, and readings taken in this way can only be very approximate and of comparative value.

The umbrascope and carboscope involve the use of tinted glasses of varying densities, and with these the actual smoke is compared. Both have half discs of clear glass but the latter has a revolving diaphragm. Owen's smoke density indicator[1] has a series of revolving vanes with gaps between them of which the widths can be varied (Fig. 12), so that the light can be obstructed to a varying extent. The appearance of the revolving disc is then matched with the appearance of the smoke leaving the stack (Fig 13), but this also is subject to the same kinds of objections as the Ringelmann chart. There is room, therefore, for an instrument that smoke inspectors can use conveniently and that can be employed with a reasonable degree of accuracy.

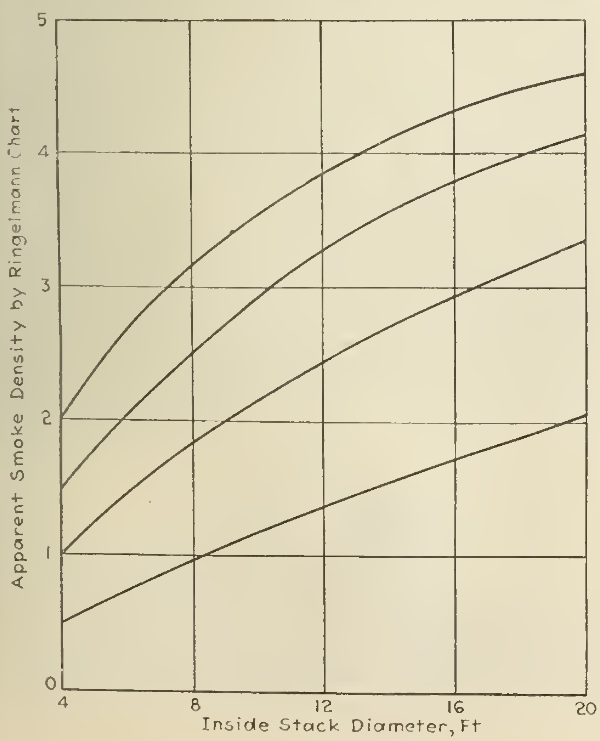


Fig. 11

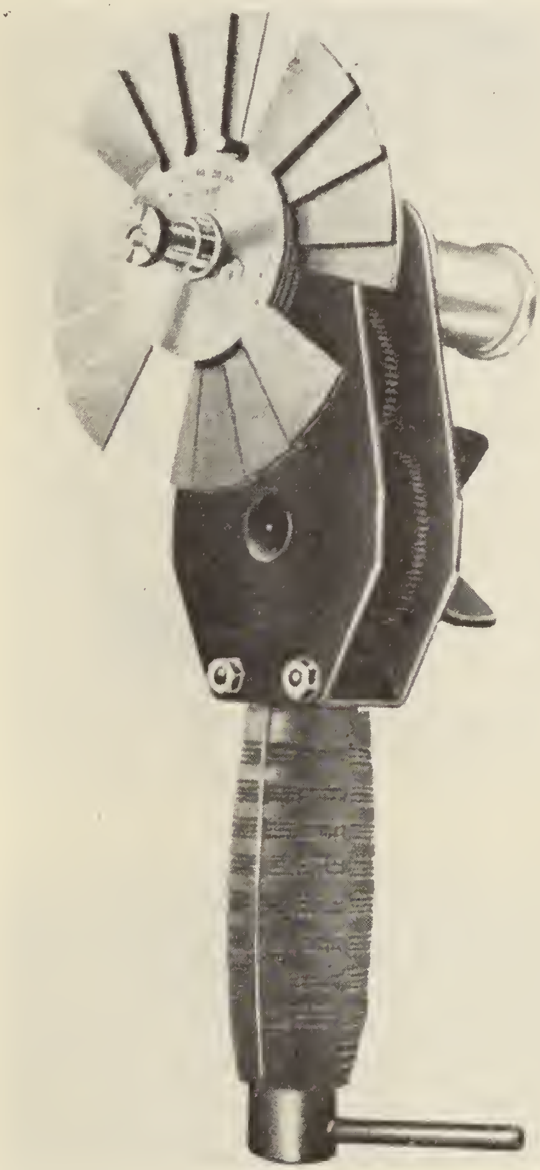


Fig. 12

What remedies are available ?

In many instances, the appropriate remedies are indicated by the causes, but in most cases smoke eliminating devices cost money, and therefore, the question arises as to the relative cost of the different methods that are available in any particular case. Also, as stated before, where legal action is contemplated there must be a clear definition of what constitutes a nuisance, for it is impossible to prove anything that is not clearly defined.

Fig. 13

Smoke consuming devices which are offered for sale, usually by interested parties, are generally useless. Filtering, wet baffles or washers, cyclones and bags are usually only effective in the case of comparatively large particles where their efficiency may be as high as 98 to 100 per cent.[8] In most instances however, their resistance increases rapidly with their efficiency and, therefore, sufficient pressure must be available, either in the form of natural draft or fan pressure, to overcome that resistance in the most economical manner. Baffles or filters may have low resistances to begin with, but afterwards their resistance is liable to build up considerably in a comparatively short time. Either frequent cleaning is necessary or a very strong draft must be available.

Electrostatic precipitators have been used successfully, both for metallurgical furnaces and for the removal of fly ash in the case of large power plants[1], but these are somewhat expensive and it is doubtful whether they can be installed economically in small plants.

Improved combustion conditions as indicated above, are the best means of avoiding incomplete combustion and, in this connection, a good deal of attention has been paid recently to the use of air jets above the fire. These may be operated either by blowers or steam jets. They supply the necessary secondary air and provide turbulence. Charts indicating the pressure, jet diameter and the degree of air penetration, together with the proper locations of these jets in various cases (Fig. 14), have been published by the fuel research laboratory, Battelle Institute.[23] It is estimated that light smoke requires about 10 per cent secondary air, moderate smoke 20 per cent and heavy smoke 30 per cent for a uniformly smoking bed. The penetration for uniform smoke should be generally about equal to the grate length. In some instances, the amount of air supplied in this way is controlled automatically by a photo-electric cell and, by this means, a boiler plant in Louisville, Ky., saved about $660 a year in the cost of steam used for the jets.[22] The boiler in question produced one million pounds of steam a day, and by automatic control the steam consumption of the jets was reduced from twenty thousand to ten thousand pounds a day.

While air jets are not to be considered as a cure-all for the smoke problem, they have been applied successfully to locomotives and to stationary boilers. A test on a 107 hp. horizontal return tube boiler at Ohio State University[24] showed that the efficiency of the boiler was not affected by the use of the jets, which were run by a blower, and that the smoke density was reduced considerably.

With regard to combustion conditions generally, much useful information is given in the manual of instructions on proper firing methods which was published in 1945 by the Smoke Prevention Association of America.[19] Probably one of the most effective methods is the greater use of central or block heating, where large and efficient furnaces may be used and skilled continuous attention is available.

What organization is required?

Most authorities are agreed that compulsion is no cure, but that in the case of stubborn operators, some degree of compulsion must nevertheless be provided. Experience in other fields has shown that no legislation is effective unless it has popular support and, therefore, that questions of public consciousness and responsibility have an important bearing on this problem.

In view of the fact already pointed out, that atmospheric pollution is general as well as local, it is apparent that, in polluted areas, smoke regulations should be organized by districts rather than by individual municipalities. It has been suggested, on many occasions, that smoke commissions should be set up to regulate smoke and also to educate citizens in the necessity for smoke control. In disputed cases where prosecution is being undertaken, there should preferably be some impartial referee who could give the necessary decisions or advice.[15] Results from such a campaign should not be expected immediately, for as has been stated above, a proper smoke survey takes several years to complete. Substantial results can be obtained, however, by a properly organized campaign. For instance, the St. Louis Smoke Ordinance was put

(Continued on page 164)

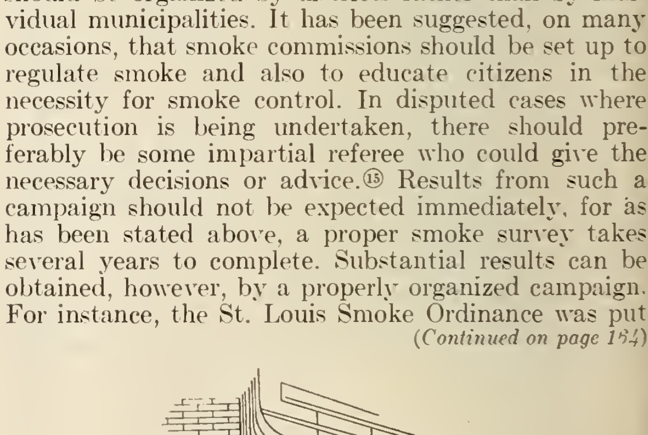


Fig. 14

STEEL RAIL PILES REPLACE CONCRETE PILES

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This article describes the use of built-up steel piles made of three rails welded together, to replace poured-in-place concrete piles which were found useless due to waisting and fracture. Reasons for the unsatisfactory results obtained with concrete piles are discussed, and suggestions given for remedying them. A description of the method of placing the steel rail piles is added and costs given.

For a certain proposed reinforced concrete building, cast-in-place concrete piles had originally been driven to carry the superstructure, dimensions of which were to be 100 ft. by 120 ft. Before the superstructure was started, however, defects in some of these piles had been observed, and the author was retained to report on the piles as driven and subsequently to procure a satisfactory foundation.

No bearing value could be assigned to the concrete piles, the unit capacity of which was intended to be fifty tons apiece. Steel piles, each made of three rails, were added. The capacity of these steel rail piles was taken as 75 and 100 tons for piles made of three 60-lb. and 70-lb. rails respectively. One hundred and one of the rail piles were driven to assume the load intended for the original 173 concrete piles.

Conditions Found Upon First Inspection

Four soil borings had been taken, one at each corner of the building. These showed an undisturbed layer of hard clay from four to five feet thick extending below the sub-grade of the basement floor, then very soft clay varying from seven to eleven feet, then silt or silt and sand varying from three to nine feet, overlying rock or boulders at an average depth of about 23 ft. below sub-grade of basement floor.

The building column spacing was 20 ft. both ways. The exterior columns, and the foundation walls, were supported by clusters of two, three, four and five concrete piles, and the interior columns by clusters of five, six and seven. The minimum distance centre to centre of piles was 3 ft. 6 in. When first inspected by the author, the site had been excavated to subgrade of the basement floor between columns. The concrete piles had all been driven and the pile rig had been removed from the site. The top of the concrete in the piles was approximately at the subgrade of the floor. Excavations for the pile caps therefore exposed stems of the piles above the cut-off to be made at the bottom of the caps. The concrete in these stems appeared to be of good quality. The stems were in general full size, namely 16 in. dia.

Excavation for some caps had been made, and a number of stems cut off. Some forms were in place ready for concreting the caps. The excavation for the caps cut almost through the hard layer of clay in some places, and elsewhere into the shadow zone between hard and plastic clay. It was reported that, while excavation was proceeding, the remaining butt of one pile appeared loose. The excavation was deepened, and it was found that the pile was waisted, that is, a section of the pile below the hard clay had the general form of an hourglass. The minimum diameter was eight inches, and the concrete was fractured at the waist. Other footings were then excavated deeper and waisting was found on a large percentage of the piles then exposed, the diameter varying between eight and sixteen inches (Fig. 1). Figure 2 shows the waisted and fractured stem of a pile.

While the waisting of some piles was not excessive, the reduction in area of others was so great that the reported design load of 50 tons would impose a unit stress in excess of 2000 lb. per sq. in. It appeared that a loading test might show that a reasonable factor of safety existed, in spite of the severe waisting. The advisability of such a test was considered until it was shown that the waisting was accompanied in certain places by a fractured condition. Apparently the partly hardened concrete in some piles had been disturbed, probably by driving adjoining piles, until there was no allowable value in the waisted section. Clay had been forced into the cracks in the concrete in some piles, and was found in the centre of the piles in horizontal, vertical and oblique cracks.

Procedure in Placing the Original Concrete Piles Described

The pile subcontractor claimed that the procedure was as outlined in their published literature and had been used successfully on many jobs. In general, this procedure consisted of driving a steel tube (¾ in. thick walls and 14 in. inside dia.) on the bottom of which was fitted a cast iron shoe. Ground water was kept from entering the tube by a grummet of oakum between the shoe and tube. A single acting steam hammer was used, the kinetic energy of blow being approx. 15,000 ft. lb. The safe carrying capacity per pile was taken as 50 tons for a penetration of 0.1 in. When this penetration was obtained, the tube was filled with concrete and the tube withdrawn. The withdrawing action was by means of a pile line to the winch on the pile rig, the hammer alternately acting up and down, 80 cycles per minute, driving the tube up and driving it

Fig. 1—Typical example "waisting" found on concrete piles.

Fig. 2—Example of a waisted and fractured pile.

down part of the distance raised by the upstroke. Each cycle was supposed to raise the tube about one-half inch. It is claimed that the downstroke tamps and consolidates the concrete against the soil in the space left by the receding tube.

Standard Portland cement was used in the concrete, and there was no reinforcing steel in the piles. The portion of the pile in the hard clay layer showed excellent surface corrugations because of the tamping (Fig. 3). It should be noted that this figure shows corrugation spacing of 1.3 in. and 2.4 in., which must have been the difference between upward and downward movements of the tube as it was withdrawn.

Apparent Reasons Why Waisting had Occurred

It was evident that the waisting was due to insufficient pressure from the green concrete to balance the surrounding soil pressure in the plastic clay. It was logical that the waisting might occur towards the top of the plastic clay where the pressure from the concrete would be less than lower down. The specific gravity of the concrete is nearly one and one-half times that of the soil, and it would naturally be thought that a head of concrete in the tube up to the subgrade level would exert an outward pressure for any location of the bottom of the tube. Such a head should be sufficient, providing the consistency of the concrete and rate of raising the tube were such that the outward pressure of the concrete was not reduced even momentarily below the inward soil pressure.

If the raising rates shown in Fig. 3 in the harder clay were used in the plastic clay, it is probable that momentary relief of outward pressure of concrete was given, resulting in the waisting. The plastic clay underlying the hard clay is so soft that a steel pile may be forced down several feet under the dead weight of the pile hammer. It seems that the tube should be raised in very small increments, if waisting is to be avoided.

Causes of Fracturing

The fracturing of the concrete at the waisted section was due to driving adjoining piles.

Displacements of soil when adjoining piles were driven undoubtedly raised the hard clay layer. The top of a pile already driven would have a good grip on this layer, due to the corrugations forced into the hard clay (Fig. 3). The concrete in the pile would be subjected to a vertical tensile pull and failure would occur at the waist where the section of concrete would be the smallest. The observation of a clay layer in several horizontal cracks leads to the conclusion that fracturing at the waisted sections was due chiefly to uplift.

Difference in lateral displacement in the hard clay and soft clay might readily produce shearing stresses in the pile sufficient to fracture concrete only a few hours old. While piles were not driven within 6 ft. of a pile already driven until the next day, it is reasonable to expect that some piles may have been driven within 16 hours of the driving of one or more of its neighbours. Even if a full 24-hour interval had been observed, the strength of the concrete would have been negligible and quite insufficient to withstand any appreciable tension or transverse shear.

Investigation Shows Concrete Piles Useless

It seemed, as already noted, that the waisting and fracturing might occur only towards the top of the very soft clay near the hard clay. If this could be proved, then the piles might safely be capped at a lower level, below the waisting. Accordingly, an open caisson of 4 ft. dia. precast concrete pipe was sunk encircling a pile. This pile including the cast iron shoe was removed. It was waisted to approximately 8 in. dia. and fractured about 18 in. above the shoe.

When excavation has been carried down a short distance into the soft clay, the majority of piles partly uncovered have been found waisted and fractured. The only pile completely uncovered has been found waisted and fractured near the bottom. While some piles may not be waisted or fractured, it is evident that there could be no assurance whatever of their condition. It was concluded, therefore, that

Fig. 3—Typical corrugations in upper portion of concrete piles through top hard clay layer.

no carrying value could be assigned to them.

There are no buildings near the back or either side of the proposed structure. Foundations for future adjacent buildings and deep trench work in the street might permit movement of the very soft clay underlying the site. Therefore spread footings or a floating mat foundation could not be considered, and it was evident that the foundation must go to rock.

Possible Substitutes Considered

Other types of cast-in-place piles were discussed. All such piles are liable, under the conditions at this site, to somewhat the same type of damage as described above due to lateral displacement. When reinforcing is omitted, they will also be liable to damage due to uplift caused by driving adjoining piles.

Four alternatives then presented themselves.

(1) CONCRETE PIPE OR OTHER TYPE OF OPEN CAISSON

The existing concrete piles would make the sinking of caissons uncertain and costly both in time and money.

(2) CREOSOTED TIMBER PILES

Because of existing concrete piles and the number of timber piles required, much larger caps with more excavation, forms, reinforcing, and concrete would be required. There was also the question of delivery of such piles.

(3) PRECAST CONCRETE PILES

Precast concrete piles could be cast and driven having 50 tons carrying capacity. Using high early strength cement, driving could start within three days of casting. Considerable reinforcing steel, then very difficult to obtain, would be required. Driving would be difficult because of existing concrete piles, and the redesign of several caps involving changes in reinforcing would be required.

(4) STEEL PILES

Standard shapes could not be obtained quickly. A satisfactory pile could be made by welding the flanges of three rails together, so that the flanges form an equilateral triangle.

A further alternative considered was a built-up pile, consisting of three 60 lb. A.S.C.E. rails, the flanges joined with three ten-inch welds at

Fig. 4—Steel rail pile of three welded rails.

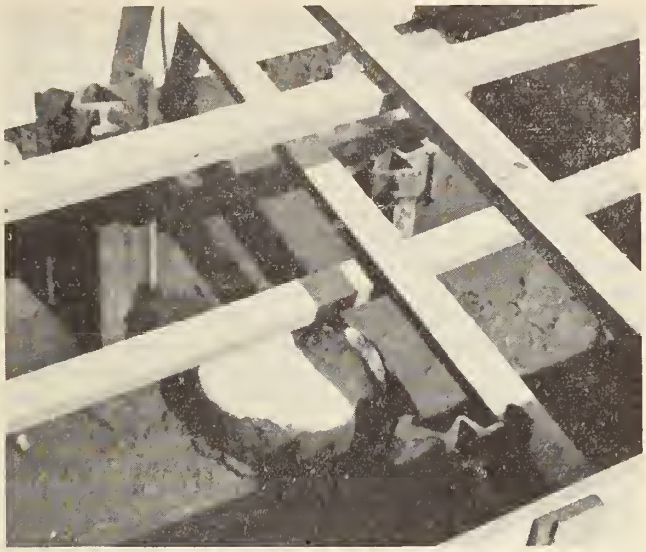

Fig. 5—Comparative sectional areas of concrete and steel rail piles.

bottom (Fig. 4), three four-inch welds at centre, and three eight-inch welds at top, will carry 150 tons for an unsupported length of 18 ft. The displacement of such a pile is small. The cross-sectional area is only 17.8 sq. in., compared to 200 sq. in. for the concrete piles then in the ground (Fig. 5).

To provide for some eccentricity of end bearing, 75 tons was considered the maximum safe load for these piles made up of 60 lb. rails, and 100 tons as the safe load for piles made up of 70 lb. rails. Pile shoes were deemed unnecessary in this case. Under other conditions any size shoe required could be attached.

Of the above alternatives, the steel rail piles offered the quickest and cheapest solution, and were therefore chosen.

Driving Performance on Steel Rail Piles

The subcontractor is to be commended for the speed with which relaying rails were secured, welded and driven. Welding and driving the steel rail piles was completed 12 days after the decision to use them was made, and 18 days after the condition of the concrete piles was known.

The piles sank through the plastic clay readily and almost under the weight of the hammer. It was thought that the hard driving before refusal would be limited to a few inches only. From 2 ft. 6 in. to 4 ft. above refusal, the driving required from four to ten blows per inch under the McKiernan Terry 9-B.2 hammer. Such hard driving had not been anticipated, and as a result some of the welds were broken. Of the hundred and one piles driven, the three welds at the top were intact after driving on seventy-three of them. One of the three welds was cracked on thirteen piles, two on eight more piles, and all three on a further seven piles.

The hard driving showed that the length of pile unsupported laterally, except for the plastic clay, was reduced from 18 ft. as originally anticipated to a maximum of 15 ft. Therefore, providing the rails could be maintained in their triangular relationship, the rails would carry the loads assigned to them, even though all flange welds cracked. As soon as cracks in the welds at the top appeared, two bands were added on all piles. These bands were of ¼ in. by

2 in. steel, welded in place about 3 ft. each side of the centre of length, or at approximately the third points in the length unsupported except for the plastic clay.

Cost of the Rail Piles

To avoid wasting steel, two rail stubs were butt-welded to form one of the three rails in each pile. The welding per pile then consisted of one butt weld and 78 linear inches of 1/4 in. fillet weld, used to join the flanges. The welding time required per pile was 1.9 hours for assembly and 0.3 hours for cutting off after driving and welding bearing plates in place. The total welding cost was approximately $10.00 per pile. Other costs were as usual for driving short piles weighing 1200 to 1500 lb. with a crane and suspended loads and a 9-B.2 hammer.

Conclusions Reached

The waisting of the concrete piles described above would have been avoided by the use of stiffer concrete, and an internal vibrator and by a slower extraction of the shell, using much smaller lifts per cycle of the extracting hammer.

The fracturing of the concrete at the waisted sections would also have been avoided by using high early strength cement, definitely keeping the bulb of pressure of the next pile to be driven clear of a driven pile under 24 hours old and, of course, by using reinforcing.

Cast-in-place piles should be reinforced, and when the concrete is placed with a water content above the plastic limit, the stirrups should be welded to the longitudinal steel. Care must be taken that the concrete in cast-in-place piles should be thoroughly set before the driving of other piles nearby can adversely affect it. A careful study of soil conditions, as well as continuous engineering supervision is necessary, to avoid damage when cast-in-place piles are used.

With no structural steel shapes available, the steel rail piles have undoubtedly provided the cheapest and most expeditious method of securing adequate supporting value for this building, although the bearing plates between pile cut-off and concrete are somewhat heavier than for H-beams of approximately the same net area driven as piles, and although the welding is an additional cost.

Where the unsupported length of pile, except for very soft material, is greater than was experienced in this case, rail piles should be shop welded. The length and thickness of welds beyond that necessary to develop the three rails into a column, will be governed by the weight of hammer, the weight of the pile, and the extent of hard driving.

THE SMOKE PROBLEM

(*Continued from page 160*)

into operation in April 1940 and it is stated that by 1946, smoke had been reduced by 73 per cent and heavy smoke by 81 per cent.④. The Leicester report indicates also that, as a result of a proper smoke survey, an elementary form of smoke forecasting is possible, so that it may be known in advance when unusually high concentrations of smoke are to be expected.

In conclusion, it is the author's opinion that the ultimate answer to the smoke problem is to be found in *education*, supplemented by *legislation* applied with *discrimination*.

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RECENT HIGHWAY DEVELOPMENTS IN ONTARIO

J. D. MILLAR
Deputy Minister of Highways, Ontario

A paper presented before the Niagara Peninsula Branch of The Engineering Institute of Canada on November 28th, 1946

The author outlines the objectives set for the 1946 highway construction programme for the province of Ontario, and tells in what measure these objectives have been attained. Particular mention is made of new Toronto-Barrie highway.

Highway administrators know only too well the problem that faces manufacturers, distributors and retailers in this first post-war year. Of the demands for consumer goods in short supply, there is possibly none greater than that for the replacement and improvement of highways seriously damaged by the strain of the war years. Repairs have lagged far behind the destruction caused by exceptional wartime commercial traffic. The casual motorist found his long distance driving sharply curtailed by gasoline rationing and shortage of tires during the war. He has returned to the open road to find the highway systems of this continent greatly deteriorated from their former condition—and he does not like it. He is paying heavily in gasoline taxes and licence fees for adequate highway facilities. Consequently he has no hesitation in asking for the restoration of the pre-war standards of construction and maintenance to which he was accustomed.

1946 Objectives

In Ontario, every effort is being made to meet this demand. The highway budget, estimated at more than $47 millions for the current year, is the largest in the history of the province. Even in the face of continuing shortages of various road building materials and skilled labour, there will be completed the largest milage of new highways ever added to the system in any single year. By the time weather conditions call a halt to the season's paving operations there will be added some 300 miles of new paved surface. This comprises 130 miles of light road-mixed mulch, 160 miles of hot-mixed bituminous macadam and 10 miles of cement concrete.

More than 190 miles of grading on new highways is under contract, which at the time of writing is 60 per cent complete and which, it is hoped, will be more than 75 per cent complete before the end of the calendar year (1946). To restore existing pavements to their former condition, over 140 miles of hot-mixed macadam has been laid in varying thickness of from two to seven inches. To improve existing gravel road surfaces which cannot be paved immediately, some 1800 miles have been treated with a heavy coating of dust laying oil or "prime".

To this programme on the King's Highways, which are under the direct jurisdiction of the province, is added the heavy expenditures being made by the Counties and Townships, which are subsidized 50 to 80 per cent by the Highways Department. During the current year (1946), the rural municipalities are investing an amount equal to nearly half the total being expended by the department on the provincial system.

Programme for Northern and Northwestern Ontario

While the above mentioned expenditures appear large for a province having a population of slightly over four millions, it must be borne in mind that they are spread over nearly one-third of the widest expanse of the North American continent. For more than 1200 miles across some of the richest and yet the most forbidding and desolate sections of Canada, the Ontario King's Highways stretch from eastern New York State to western Minnesota. In this far-flung empire of agricultural, industrial, mining and lumbering developments transportation is a vital need. The joining of the eastern and northwestern portions of the province by road was accomplished during the war years. Current interest in the northern part of the province fastens on the rapid expansion of the highway system to meet the pressing demands of the mines, the lumbering industry and the tourist trade.

North from Quibell in the district of Kenora is being pushed a road which is possibly the forerunner of many pioneer routes to open the area north of the height-of-land. With its completion, the frontier in north-western Ontario will be set back nearly 100 miles. The Red Lake mining camp, instead of being an outpost of civilization, will become the centre of mining developments, whose full potential can only be conjectured. Another mining road sharing the spotlight with Red Lake is that being constructed from Matheson easterly into the Lightning River basin. Rated by many to rival the Kirkland-Larder Lake area in the years to come, development of this field has been at a standstill until transportation could be provided.

Programme for Central Ontario

Throughout central Ontario, the great bulk of the work of the Highways Department has been to modernize and pave established highways and "finish the job" undertaken some years ago of mak-

Fig. 1—Grading a deep cut with elevating grader on new Toronto-Barrie highway.

Fig. 2—Sub-grade on a level stretch of the new Toronto-Barrie highway, showing width and easy alignment.

ing the provincial parks and forest reserves accessible to the tourist traffic. An extensive paving programme has been carried out in this area which extends roughly from the district of Muskoka northerly to Hearst and from Renfrew on the east, west to Sault Ste. Marie. Many miles of grading completed prior to the war were surfaced either with permanent pavements or with light bituminous top sufficient for automobile and light truck traffic. With the exception of a 13-mile gap in the Timagami Reserve, Highway 11 now has continuous pavement from Toronto to Kirkland Lake. This is a major accomplishment when it is remembered that only twenty years ago many sections of this highway did not exist north of the city of North Bay, and that ten years ago only a small portion of this entire stretch was paved.

A considerable milage of what are called " development " roads has been built during the current year throughout this extensive area. Along with northwestern Ontario, it forms the great playground of the province. It is the drawing-card which makes Ontario the Mecca of many millions of visitors each year. Agriculture, mining and lumbering have benefited materially by the extension of roads of this type, which are rapidly opening many inaccessible lakes and rivers for the use of generations to come.

Programme for Southern Ontario

In the older and more heavily populated southern area of the province the most pressing problem facing the department was the rebuilding of war-damaged main arteries of traffic. The great bulk of the paving and resurfacing programme above mentioned has been concentrated here to prevent further deterioration of old pavements. Gaps had to be closed in the main arteries of traffic, which had been without attention in many cases for more than five years. Nearly fifty miles of " Ontario's Main Street ", or Highway 2, stretching from Windsor through Chatham, London, Hamilton, Toronto, Oshawa, Belleville, Kingston and Cornwall to the Quebec border have been resurfaced. Pavement has been laid on gravel sections of many important highways, particularly in the rich agricultural lands of southwestern Ontario and in the Ottawa and St. Lawrence valleys. Very little new grading work, except in connection with paving, has been undertaken in these districts, as the need for pavement was the most pressing.

Coupled with the need for pavement in the older portions of the province and the development of new highways reaching into New Ontario, has come the necessity of relieving congestion on those highways in the immediate vicinity of the large centres of population. Carrying the greatest concentration of traffic known in the province, the highways from Toronto to Hamilton had become obsolete. Prior to the war these had been supplemented by the divided type highway known as the Queen Elizabeth Way, familiar throughout the province for its utility and beauty. The continuation of this same type of construction east of Toronto had been undertaken before the war, but its final completion to Oshawa had been suspended. During the current year the remaining eighteen-mile section from West Hill to Oshawa was placed under contract for paving. By the close of the year's operations this will be more than one-third complete.

The Toronto-Barrie Highway

It is, however, the relief of congestion on Yonge Street, or Highway 11, running north from Toronto, which has been most insistently sought by motorists both at home and abroad. As one of the oldest established routes in the province, its strategic importance for many years has ruled against any drastic change in its location. Various attempts have been made from time to time to adapt this heavily settled and very hilly route to the use of the motor vehicle. Throughout the southerly end of the fifty mile section between Toronto and Barrie a continuous line of towns made the highway almost an urban street. To bring about any substantial improvement in grades on this line would have meant the disruption of all these towns, if any heavy cutting were done.

In the light of experience with the Queen Eliza-

Fig. 3—A paver at work on the Toronto-Oshawa highway, July, 1946.

Fig. 4—Grubbing with a dragline on the new Red Lake highway, summer 1946.

Fig. 5—Peacetime use for war equipment, Red Lake highway, summer 1946.

beth Way and similar highways, such as the Pennsylvania Turnpike and the Westchester County highways in New York State, it was decided that permanent improvement could only be accomplished by building an entirely new road. After more than two years of study and comparison of various lines, it was decided to follow a route along the back of the lot lines in the centre of the fifth concession of the townships of York, Vaughan and King in the county of York. A slight westerly deflection was found necessary across the Holland marsh and following the line between Lots 6 and 7 across the townships of West Gwillimbury and Innisfil in the county of Simcoe. The line thus chosen, while avoiding the hills adjacent to Yonge Street, is still in a direct line southerly from Barrie, and is adaptable to a satisfactory connection into the heart of the city of Toronto.

This highway, about sixty per cent graded at the time of writing, is known as a "controlled-access highway", a phrase coined in Ontario to describe most accurately the purpose for which it is intended. It is a road which will have points of entry at distances of from three to five miles apart at the intersection of the main highway and county road crossings. Between these points, traffic will flow without interference from the side, and the congestion and hazard of level crossing intersections will be eliminated. It will form a continuation of the Queen Elizabeth Way leading from Fort Erie through Niagara Falls and Hamilton to Toronto and northerly to Barrie. At Barrie, traffic will branch off for Owen Sound, for Midland, for Huntsville and the Algonquin Park and North Bay. In conjunction with a new highway of similar type being constructed by the State of New York from Buffalo, Albany and New York City, it will place the heart of the eastern United States within two days' easy driving distance of the central part of the province.

Congestion and Hazards to Be Overcome

The completion of this road will remove from Yonge Street those vehicles wishing to proceed to Barrie and beyond. These represent more than fifty per cent of the present traffic throughout the entire year, and a much higher percentage during the peak months of the summer. As has been the case with the Queen Elizabeth Way, it will draw to itself traffic from many other districts in the area bounded by Owen Sound on the west and the Algonquin Park on the east. It will relieve other highways from the congestion of holiday week-end travel. It is a highway conceived in the light of past experience and anticipating traffic conditions as they will be, not at the present, but in the course of the next quarter-century. It will be part of the main frame-work, to which are connected the other roads of the central and northern part of the province.

Every safety feature known to road building science is being incorporated into this highway. It will serve not only Toronto, but motorists from all over the province. It will be equally important to the miner at Timmins, to the resort owner in the Timagami park, to the market gardener in the Holland marsh, as it is to the residents of Toronto themselves. Over this highway in the years to come will flow the products of the forest, of the farmland, of the manufacturer and, along with them, the tourist traffic which today represents an industry almost as important as the others mentioned. In the saving of lives it will materially reduce the number of tragic accidents presently occurring on the congested arteries of the central part of the province.

Bridges Deferred

Such then are the highlights of the year's programme of highway building in Ontario. As will be noted, very little mention has been made of the construction of new bridges. This unfortunately has been one problem incapable of solution, with the present shortage of steel, cement and lumber. It is sincerely hoped that before the 1947 construction season these materials will be available in sufficient quantities to allow the replacement of bridges. There are many of these on existing main highways, as well as many hundreds on the lesser travelled arteries throughout the province, which are badly in need of attention. There is no alternative, however, except to defer work of this kind until at least one of the three materials mentioned is available.

Motorists of the province have been very patient and understanding of the problems facing the department in this first post-war year. It is hoped that this brief review will present the case of the men behind the counter when they have to report that certain products are still "temporarily out of stock".

From Month to Month

News of the Institute and other Societies, Comments and Correspondence, Elections and Transfers

LOW SALARIES AND DEPRESSIONS

The relationship between low salaries for engineers and an economic depression was easily discernible in the report of the New Development Committee of the Canadian Construction Association presented at the annual meeting of the Association.

The report is based on the results of a survey made by the committee through a questionnaire sent to the Dominion and provincial ministers of reconstruction. It asked what planning of deferable projects had been completed by each province and by the Dominion. Answers were received from all but one province but only two made any pretence of completing the form. The showing was extremely discouraging, for it appears that in almost no instance has the planning progressed to the point where it could be a real hedge against unemployment.

Two provinces admitted frankly that they had done no planning. Two others had completed only an insignificant amount. Two other provinces, Saskatchewan and Ontario, reported work completed to an extent almost double their portion of the hoped for $500 million reserve for all of Canada. Such excess amounts however, could not be used in combating a depression in its first year, and therefore should not be included in the minimum figures for a one-year reserve.

The total of all work now planned on a one-year basis according to the survey is $278 millions, against the objective of $500 millions. As all projects which hope to receive financial assistance from the Dominion government must be approved by the Department of Reconstruction, it is quite possible that some of these now reported by the provinces may not be approved, in which case the figures for the reserve would be reduced.

The figure of $278 million may well be questioned inasmuch as the Department of Reconstruction in January this year issued a statement that the reserve, including projects still in the process of screening, amounted to only $35 million. With the Canadian construction industry able to handle $800 million of work in one year as it did during the war, $35 million is rather insignificant. The department stated at the same time that $700 million of work had been " considered ", and that this amount may be said to be the potential reserve. There is a vast difference between $35 million planned and $700 million on which the department states " there is agreement that future construction would be in the national interest ".

Any way it is examined the showing is not encouraging. The total volume is inadequate, the distribution across Canada is uneven and the type of work lacks the variety necessary to produce maximum employment. It is to be hoped that an even balance can be established between building projects and engineering projects. During the war engineering work dropped to about one-third of the total instead of the one-half which it maintained in peacetime.

It is impossible to overstress the urgency and necessity of building up a proper reserve. Not only is there a great need for public work projects such as hospitals, schools and other institutions, recreational and community centres, highways and municipal services, but there may well be an urgent need for a ready programme to step into the breach, if as and when private business nears the end of its present abundant programme.

We must never again see " make work " projects such as followed the 1914-18 war when $800 million was spent for almost nothing. Surely human beings can read the lessons that come from experiences through which they have lived. There is no need to take someone's word for it. The magnitude of the objective must not be underestimated, and yet those in authority must not despair of reaching it. The issue is so clear in the minds of all people that there can be no doubt of where the responsibility will lie if they fail.

The report of the committee places considerable responsibility for the present unsatisfactory situation on the shortage of technical personnel available to the government service, and indicates that remuneration is the basis of the shortage. It says—

"A. It is evident to our Committee that extremely unsatisfactory progress in planning exists on a wide front. The reasons for this are mainly as follows:—

1. Failure of the Dominion-Provincial Conference to implement the Dominion's proposals on planning, with resulting delay in establishing planning grants by the Dominion to provinces and municipalities.
2. The critical shortage of planning personnel, due to insufficient numbers having been trained, and to the loss of large numbers by emigration, and
3. The low salary scales for technical persons offered by the Dominion and provincial governments, in contrast to those paid by industry ".

For countless years the Institute has been pressing the Federal authorities to recognize the importance of the work they have to do and the competency of their staffs to do it. Over these years some minor improvements have come to pass, but on the whole the situation is still far from satisfactory, and still far from indicating that the authorities have any conception of their responsibilities. If this short sightedness and bad administration prevents proper planning for the future, there is going to be an awful price to pay some day by someone.

Canadians will appreciate the good work done by the association's committee in exposing the situation. Let us hope their efforts will help to produce the needed results before it is too late.

NEW OFFICERS CORPORATION OF PROFESSIONAL ENGINEERS OF QUEBEC

At the annual meeting of the Corporation of Professional Engineers of Quebec held in the Ecole Polytechnique auditorium on Saturday, March 29th, 1947, the results of the recent elections for councillors were announced. The new Council held its first meeting and announced the new officers for 1947-1948 as follows:

President: Ernest Lavigne, Quebec.
Vice-President: J. B. Stirling, Montreal.
Secretary-Treasurer: J. A. Lalonde, Montreal.
Councillors: Louis Beaudry, Quebec; Leo Dufresne, Quebec; J. A. H. Henderson, Montreal; F. S. Howes, Montreal; J. W. McCammon, Montreal.

STAFF CHANGE

It is a matter of more than ordinary concern to the Institute that Louis Trudel who for over eight years has been assistant general secretary is leaving the organization to take a more senior appointment elsewhere. Members everywhere will regret this change but will wish him continuing success in his new activities.

Louis Trudel, M.E.I.C.

Fortunately for the Institute Mr. Trudel's new employer has given him leave of absence from April 1st to May 15th in order that he may complete the preparations for the annual meeting. This followed an explanation by the president of the Institute to Mr. James Wilson, president of Shawinigan Water and Power Co., which emphasized the serious position in which the Institute would find itself if Mr. Trudel's services were lost before the annual meeting. In reply Mr. Wilson graciously proposed the leave of absence. This gesture of understanding and helpfulness will be of real benefit to the members and particularly to Headquarters.

It will not be easy to replace Louis. His years of experience plus his natural talents have made him a most valuable and valued officer of the Institute. His untiring efforts, his intelligence and his geniality have endeared him to all who have had the privilege of knowing him. The services he has rendered are unique, and not many persons outside of a few officers and his associates at Headquarters really know the breadth and depth of his contribution to the success of the Institute.

It is of some consolation to members in Montreal to know that he is not leaving the city. Perhaps through a multitude of established channels he will be able to continue his contributions to life within the organization, and will remain an integral part of it all.

COMMITTEE WILL STUDY QUALITY CONTROL METHODS

A Special Committee has just been established by the National Research Council to promote the application of mathematical methods in the treatment of certain industrial production problems. Techniques in this field are now being widely used and it is estimated that, in the United States, some 4,000 persons are currently engaged in statistical quality control work.

Industries have achieved marked success with sampling inspection schemes which are used by manufacturers to control the quality or dimensions of mass-produced articles through the testing of a small fraction of the total output. Purchasers have also put acceptance-testing on an actuarial basis. Sample surveys of consumer requirements, welfare conditions, etc., provide data that can be used for a variety of purposes. In the experimental sciences, research workers find it necessary to make statistical analyses of their data for the proper planning and analysis of tests which must be undertaken with variable materials. The special techniques required in this comparatively new field of work are based on the mathematical theory of probability and special skills are required in the adaptation of these techniques for various purposes. Members of the Council's committee include specialists in statistical quality control procedures, in sampling surveys, in the design of experiments, and in biometry or the statistical study of variation.

The Committee will assist Canadian users of mathematical statistical methods by consultation and advice respecting specific technical problems, will support research in this field by qualified workers, and provide a means of liaison with technical groups in Canada and abroad. Chairman of the Committee is Dr. J. W. Hopkins, National Research Council, Ottawa.

A.I.E.E. MONTREAL MEETING FEATURES

For the 62nd Annual Summer Convention of the A.I.E.E. to be held in Montreal, Que., June 9-13, 1947, the Summer Convention Committee has planned, in addition to the excellent technical sessions, a programme of entertainment, inspection trips and recreation, which should make the Convention attractive as a vacation as well as of benefit professionally. Convention headquarters will be at the Mount Royal Hotel, in the heart of the city. Members of the Engineering Institute are cordially invited to participate in the meeting.

Entertainment

Excellent programmes for both men and women have been planned by the Hospitality and Sports Committees. Among the hospitality features for the men are the president's reception and cocktail hour, a smoker with refreshments and entertainment, and for both men and women is the famous Saguenay Boat Trip.

SAGUENAY BOAT TRIP:

The boat will leave Victoria Pier, Montreal, on Friday, June 13th at 6 p.m., arriving at Bagotville on the Saguenay River at 5 p.m. Saturday, June 14th. The scenery on this trip is some of the most impressive in the world. On arrival at Bagotville a trip to the Shipshaw Power Development has been arranged through the courtesy of the Aluminum Company of Canada. The boat will sail from Bagotville on Sunday morning at 1 a.m. and, on the return trip, arrangements have been made for stop overs at beautiful Murray Bay for 3½ hours and also at Quebec City from 3.30 in the afternoon until 8 o'clock at night. Passengers will thus have an opportunity to visit this historic city during daylight hours. The boat will dock in Montreal at 6 a.m. Monday, June 16th.

Note: The boat leaving on Friday, June 13th, has been completely reserved for members attending the A.I.E.E. Convention. In addition, arrangements have been made to take care of any overflow on the regular trip sailing from Montreal Saturday afternoon, June 14th, and returning to Montreal on Tuesday morning, June 17th.

SMOKER:

Tuesday, June 10th, starting at 8.30 p.m. using both the ballroom and the Normandie Roof on the ninth floor of the Mount Royal Hotel.

There will be two continuous shows, one in the Normandie Roof where tables will be provided, and food will be served from 8.30 to 11.00 p.m. An orchestra will be provided during the evening and there will be a continuous floor show, including dance teams, vocalists, sleight of hand artists and other acts.

At the same time, a carnival type of show will be in continuous operation in the ballroom. Beer will be available at a bar in this room and there will be continuous orchestra music, boxing matches, games of chance, tumbling acts, juggling and other entertainment.

Accommodation will be limited to 900 and it is suggested that reservations should be made at the earliest possible date.

LADIES' ENTERTAINMENT:

Open house will be held all day Monday, June 9th, for the ladies in one of the Mount Royal Hotel salons where they may avail themselves of the opportunity to meet old friends and to make new ones.

On the following day, there will be a Fashion Show and tea at one of the leading Montreal department stores at 3.30 in the afternoon.

On Tuesday evening, June 10th, arrangements have been made to hold a card party at the Mount Royal Hotel. A light lunch will be served and prizes distributed.

One of the features of the Ladies' Entertainment will be a Laurentian Mountains Tour. On Wednesday, June 11th, buses will leave the Mount Royal Hotel at 10 a.m. and return towards 5 p.m. This tour presents an excellent opportunity to secure a view of the playground of eastern Canada. The tour consists of a 100-mile trip through a region covered with lakes and rivers in a mountainous setting. Lunch will be served at the Alpine Inn where an opportunity will be given the guests to walk about and view the exceptional scenery.

On Thursday afternoon, June 12th, arrangements have been made for a sightseeing tour of Montreal, ending with a visit to the Botanical Gardens. Buses will leave the Mount Royal Hotel at 1 p.m. and return at 4.30 p.m. During the tour, there will be an opportunity to visit many of the main points of interest within the city, such as St. Joseph's Shrine, Notre Dame Cathedral, the old business area with its narrow streets, the city buildings, the Chateau de Ramezay, constructed between the years 1705 and 1723 and now being used as a museum, the markets, harbour, parks and residential areas. Towards the end of the tour, tea will be served at the Botanical Gardens.

GOLF:

The Sports Committee are making arrangements for a full golfing programme.

Inspection Trips

BEAUHARNOIS POWER PLANT:

This is one of Canada's largest hydro-electric installations and is located on the shores of Lake St. Louis, some 22 miles west of Montreal. The power house itself is over 1,000 ft. long and contains 14 generating units, aggregating 650,000 hp. The development utilizes the normal drop of 82 ft. between Lake St. Francis and Lake St. Louis on the St. Lawrence River.

On the trip one of the points of interest will be the Indian village of Caughnawaga, founded in 1716, and still retaining many features of the early atmosphere.

SCENIC TOUR OF MONTREAL:

A tour has been arranged, exceeding two hours in length, in which delegates will see Montreal at its best: the unequalled Notre Dame Cathedral, the Chateau de Ramezay, built in 1705 as the Governor's residence, St. Joseph's Oratory (a world famous shrine), McGill University, Montreal's beautiful residential areas, factory districts, financial centres, the old French district and many scenic subjects of the historic city.

MCGILL CYCLOTRON:

For delegates interested in nuclear research, an inspection trip has been arranged to the cyclotron laboratory at McGill University.

At the time of its undertaking, this cyclotron was of unique design and the largest of its type.

Much of Lord Rutherford's early work in nuclear physics was done at McGill and, since then, the University has contributed many prominent names connected with the developments leading to the atomic bomb. It is not expected that the cyclotron will be completed at the time of the Convention but the delegates will be able to see many components of this highly complex machine in a state of assembly.

INSPECTION OF THE SHIPSHAW POWER DEVELOPMENT:

For those delegates taking the boat trip from Montreal to the Saguenay, the Committee has arranged a special side journey of outstanding engineering interest. The delegates will be taken from the boat side to the Shipshaw development of the Aluminum Company of Canada. The Shipshaw development comprises two generating stations with a total installed capacity of 1,500,000 hp.

In addition to the above trip, the Inspection Trip Committee has arranged for limited accommodation on a commercial air line on June 11th for delegates who, by force of circumstances, are unable to spare the time for the boat trip. This trip can accommodate only 28 persons and delegates wishing to take advantage are cautioned to request space well in advance. Accommodation will not be held later than 10 a.m. June 10th.

Hotel Accommodations

The Hotel Committee has been fortunate in securing block reservations at a group of hotels. All are within a short distance of Convention Headquarters.

Single rooms will not be available. To facilitate the work of the Committee, delegates should indicate with whom they desire to share a room or preferably, make a joint reservation.

Reservations

Delegates should make their reservations now for all events, and especially for their hotel accommodation and the Saguenay Boat Trip. Address all requests to Mr. G. H. Gillett, c/o Canadian General Electric Company, 1000 Beaver Hall Hill, Montreal, Que.

PRESIDENT HAYES VISITS MARITIME BRANCHES

With the completion of his visits to the branches in the Maritimes last month, J. B. Hayes of Halifax has become the most travelled president in the history of the Institute. This is accounted for by the fact that there are now 28 branches, two of which were inaugurated in the past year, and that he represented the Institute at a Commonwealth Conference of Engineering Institutions held in London last September. Following the practice established in recent years, the president in the course of his branch visits called upon most of the universities across Canada and spoke to the students.

Other events, besides the Annual Meeting, which in the course of the year made important demands upon the president's time were the Semi-Annual Meeting of The American Society of Mechanical Engineers in Detroit last June and the Maritime Professional Meeting of the Institute at Digby, N.S., in September.

Moncton

The presidential party, throughout the maritime tour, consisted of President and Mrs. Hayes, Councillor and Mrs. G. J. Currie of Halifax, and the assistant general secretary from Headquarters. Other officers joined the group for various parts of the trip as indicated later.

The tour was inaugurated at Moncton on March 12th. Soon after arrival the party was taken on an inspection trip, with executive officers of the branch and their wives, through the Ice Manufacturing Company and the Marvens Biscuit Company's plants, and the Trans-Canada Air Lines airport.

A dinner, with the ladies present, was held in the evening at the Brunswick Hotel. In the absence of Branch Chairman E. R. Evans, Past Vice-President George L. Dickson directed the proceedings in a most informal and pleasant fashion. Invited to say a few words, Mayor Bridges paid tribute to the Moncton Branch whose members had been of great help to the City in the recent water supply emergency. The president was the principal speaker and was followed by Councillor Currie, the assistant general secretary and W. C. MacDonald. Attention was called to the fact that C. G. S. Rogers and H. J. Crudge, both past officers of the branch, had attained the distinction of Life Members. Visitors from other branches were Mr. and Mrs. N. F. Nutter from Truro, R. M. Richardson from Saint John, N.B., and C. D. Martin, Halifax.

Fredericton

Upon arrival at Saint John, the next morning, the party were met at the station by branch executives and later a caravan of several automobiles set out for Fredericton by the river road. Saint John members who accompanied the presidential party on this now traditional excursion to Fredericton were Councillors G. M. Brown and A. A. Turnbull, Past Vice-President G. G. Murdoch, Chairman L. O. Cass, Secretary K. W. Salmon, J. T. Turnbull, V. S. Chestnut, A. R. Bonnell, C. D. McAllister.

At the luncheon meeting presided over by John A. Scovil, president of the University of New Brunswick Engineering Society, there were present Milton V. Gregg, president of the University, several members from Fredericton and about 90 students, all members of the Institute. In view of this display of interest, the opinion was expressed by Professor E. O. Turner and heartily endorsed by the meeting, that application in

PRESIDENTIAL VISIT TO SACKVILLE

At left, left to right: President J. B. Hayes, H. W. McKiel, Dean of Science at Mount Allison, Mrs. Hayes and President Flemington of Mount Allison.

Above, left to right: Professor West, Mrs. McKiel, Wing Commander C. F. Johns, and Mrs. Flemington.

Below: The students at Mount Allison hear President Hayes speak.

THE PRESIDENT IN SAINT JOHN

Mrs. G. J. Currie responds to the toast to the ladies.

Head table, left to right: General Secretary L. A. Wright, Mrs. Currie, Vice-President C. M. Anson, President Hayes, Branch Chairman L. O. Cass, Mrs. Hayes, Mayor McKenna.

F. A. Patriquen (fourth from the left) and C. D. McAllister (extreme right) are seen in the above group.

Above, left to right: B. E. Bayne, V. S. Chestnut, J. T. Turnbull, Mrs. Mooney, Mrs. Turnbull, J. P. Mooney.

Above, left to right: Mrs. McKinney, T. C. Macnabb, Mrs. Yuill, J. H. McKinney, Mrs. Macnabb, Russell Yuill, Mrs. Brown, G. M. Brown.

Mrs. Brown, J. B. Stirling, Mrs. Currie, C. M. Anson.

PRESIDENT HAYES COMPLETES HIS TOUR IN HALIFAX

Head table, left to right: Mrs. Hayes, Branch Chairman E. C. O'Leary, President Hayes, Mrs. O'Leary, Vice-President C. M. Anson.

Mrs. Hayes responds to the toast to the ladies.

The president presents the Institute prize certificate to J. P. Oakley at Nova Scotia Technical College.

Head table, left to right: Branch Secretary Kline, Mrs. Kline, G. J. Currie, Mrs. Anson, Councillor A. E. Flynn.

Above, left to right: Mrs. Kaye, J. R. Kaye, D. F. Dunham, Mrs. Dunham, E. K. Akin.

Left to right: Mrs. K. E. Bentley, I. M. Fraser, Mrs. Fraser, L. E. Mitchell, Mrs. Mitchell, K. E. Bentley.

THE PRESIDENT AT MONCTON

At left. Left to right: Mrs. Hubert Button, President J. B. Hayes, Chairman Geo. Dickson, Mrs. Hayes, Mayor Bridges, Mrs. Bridges.

At right. Part of the assembly at dinner.

the near future for the establishment of a branch of the Institute in Fredericton would be justified.

The visitors were shown through the University buildings in the afternoon and at 4 o'clock proceeded to the Convocation Hall where the students heard from President Hayes, Dr. L. Austin Wright who had joined the party at Fredericton, and Councillor Currie. A feature of the meeting was the presentation of the Institute prize certificate for 1946 to A. M. Stevens.

The visitors then joined the ladies for tea at the home of Dr. E. O. Turner after which they returned to Saint John.

Saint John

At this point, C. M. Anson of Sydney, vice-president of the Institute for the Maritimes, and Councillor J. B. Stirling of Montreal, joined the party. On Friday, March 14th, the visitors were entertained for lunch at the Union Club, Past Vice-President Murdoch doing the honours. Members of the branch executive and officers of the provincial association were present.

In the afternoon, a meeting was held between officers of the association and members of the Institute headquarters' staff in order to discuss a simplified procedure in the implementing of the co-operative agreement.

The branch meeting was held that evening at the Admiral Beatty Hotel and took the form of a dinner with ladies present. Branch Chairman L. O. Cass presided and Mayor McKenna extended the city's welcome to the visitors. A toast to the Institute was proposed by Frank P. Vaughan and responded to by President Hayes. The toast to the ladies was proposed by Otis Logue and very aptly responded to by Mrs. G. J. Currie. Other speakers were Dr. L. Austin Wright, C. M. Anson, G. J. Currie, and Louis Trudel. Visitors from other branches included B. E. Bayne, Moncton, and C. D. Martin, Halifax.

Council Meeting

On Saturday, March 15th, a regional meeting of the council was held at the Admiral Beatty Hotel. President Hayes was in the chair and, following his established custom, asked Vice-President Anson to take over for part of the proceedings.

In addition to members of council, there were also present officers of the Association of Professional Engineers of New Brunswick, past officers of the Institute in the province and members of the branch executive. A valuable discussion took place on matters of professional interest to both the provincial association and the Institute. Other questions of local interest were also dealt with such as the ratification of amendments discussed the day before with officers of the Association, and the possibility of holding a Maritime Professional Meeting in New Brunswick in the fall of 1948.

Sackville

After a quiet Sunday in Saint John, the presidential party left Monday morning, March 17th, for Sackville. At Moncton, Past Vice-President G. L. Dickson and John Hardman joined the group. At Sackville, Past-President H. W. McKiel, Dean of Science at Mount Allison, and Mrs. McKiel greeted the party at the station and took them over to Marshlands Inn where they were the guests of the owners, H. W. Read, M.E.I.C., and Mrs. Read. President Flemington of Mount Allison and Mrs. Flemington were present as well as members of the Institute in Sackville and their wives, and Dave MacCallum, president of the Engineering Undergraduate Society.

The visitors were then escorted through the University buildings by Dr. McKiel and Professor F. L. West and later addressed the students. The party, minus Messrs. Dickson and Hardman who had returned to Moncton, left Sackville by train at the end of the afternoon.

Cape Breton

Sydney was reached on the morning of March 18th after an overnight journey from Truro. The party were met at the station by Vice-President C. M. Anson, Branch Secretary Gordon Naish and Walter Graham.

At lunch that day, the visitors were guests at the Rotary Club where the Institute vice-president, Clem Anson, general manager of Dominion Steel and Coal Corporation, was the speaker and gave an interesting address on the background of Sydney's steel industry. In the afternoon, J. H. Fraser, general superintendent of Dosco's steel division, showed the visitors through

(Continued on page 178)

PRESIDENT HAYES VISITS FREDERICTON

Above: The students turned out in large numbers for the dinner.

Below, the head table. Left to right: L. O. Cass chairman of the Saint John Branch, President Hayes, J. H. Scovil, president of the Undergraduate Society of the U.N.B., Milton V. Gregg, president of the University, General Secretary L. A. Wright, Councillor G. J. Currie.

CAPE BRETON BRANCH GREETS THE PRESIDENT

Above, left to right: S. C. Mifflen, President Hayes, C. M. Anson, G. J. Currie.

Above: Chas. Smyth, Mr. Griffin, Wm. Wilson and Wm. Green.

At right: Angus F. Young and Gordon Naish.

EMPLOYER PRACTICE REGARDING ENGINEERING GRADUATES

Recently the results of an unique survey were reported to The Engineers' Council for Professional Development (E.C.P.D.), with the request that they be submitted to the constituent members of the Council for whatever action they think appropriate. The Engineering Institute is a member of E.C.P.D. and therefore is one of the eight organizations to which the report has been submitted. The survey was conducted by the Engineers' Joint Council (E.J.C.), a group made of representatives of the six leading engineering societies in the States.

The survey is unique in that it uncovers a lot of useful and interesting information other than salaries. It deals with salaries of course but is important principally for the information it provides about employers' policies and attitudes towards the graduate.

The sub-committee making the survey is careful to point out that the data are of limited scope and should be accepted with some reservation. They recommend that Engineers' Joint Council make a more complete survey along the same lines perhaps in the Fall of 1947.

Of particular interest is the information about future needs of employers. The average increase in numbers of engineers to be employed per year for the next four years is just a little less than 8 per cent. The Compton Committee report completed in April 1946 based on replies from 125 companies showed a figure of 17 per cent per year. This disagreement indicates the difficulty of obtaining thoroughly reliable information. Both reports cover about the same number of firms and apply to periods of time only three or four months apart.

It is interesting, too, to note that personality is first on the list of considerations which influence employers in examining applicants. Salary is the last item on the list. From a professional society point of view it is encouraging to see that "practically all" employers encourage membership in engineering societies, and that "travelling expenses are usually paid for attendance at meetings".

The following paragraphs make up the major portion, but do not constitute the complete report.

Introduction

The younger engineers have been actively seeking advice and guidance from the national engineering societies, of which they are junior members. The Engineers' Council for Professional Development has consistently endeavoured to better the professional status of the engineer, but in the recent years there has been an insistent request from a small but voluble portion of the junior engineers to obtain from the societies some tangible aid regarding their economic status.

The Engineers' Joint Council recognized that surveys of the engineering profession regarding salaries and advancement based upon data obtained from employees as individuals should be supplemented with a survey of employers in industry. The object of this survey is to learn directly from a representative group of industrial employers their attitudes and policies pertaining to the selection, training, placement, advancement, guidance, and professional activities of engineering graduate employees.

Before canvassing industry on a large scale, a trial questionnaire was sent in May, 1946 to 174 employers of engineers, including small and large organizations. Replies were received from 104 employers in 19 fields of industry up to August 1, and form the basis of this report. Colleges were also included, as they, too, employ the graduates of their own or other schools, as well as those who return from industry to teach.

This report has been prepared with a belief that the present data may be helpful to the Junior Engineers, the employers of engineering graduates, the colleges from which future graduates will be available for employment and the engineering societies.

Collectively the 104 cooperators employ more than 2,000,000 persons, of whom about 40,000 are engineers. Because of the representative character and distribution of the cooperators, the data received from this preliminary survey are regarded as worthy of a brief analysis and report. See summary data in the Table I.

Who Are Hired?

Ninety-six per cent of the cooperators employ cadet engineers directly upon graduation from engineering schools, but only 4 per cent recruit their engineering staffs exclusively from the new graduates. About 43 per cent hire more than half of their new engineer employees after one or more years' experience with other employers. This is evidently a matter of necessity or expediency rather than preference, because more than 60 per cent of those reporting indicate that they prefer to hire the new graduate.

How Are Cadet Engineers Recruited?

Seventy per cent of those replying send representatives to engineering schools, who interview students individually; nearly all of these discuss the candidates personally with members of college faculties, in addition to interviewing the students themselves.

Other means of recruiting new graduates are apparently of little avail.

How Are Experienced Engineers For Specific Openings Obtained?

For filling specific openings, advertising is used by 50 per cent of those replying and employment agencies by 35 per cent. Thirty-five per cent also utilize the facilities of Engineering Societies Personnel Service, Inc., 18 per cent consult placement bureaux, and 12 per cent report that their present employees bring men in. A few cooperators obtain engineers from associated companies, but United States Employment Service and the National Roster of Scientific Personnel are each used by only one company in this group.

How Are Engineering Employees Selected?

Twenty-five per cent of those reporting do not differentiate between engineers and other employees in the process of hiring. The other 75 per cent rely chiefly on personal interviews between the candidates and engineering executives, although 20 per cent of the cooperators employ aptitude or other tests for evaluating the applicant's ability.

What are the Bases on which Engineering Employees are Selected?

The questionnaire listed nine items presumably considered when selecting an engineering employee, asking each cooperator to list the order of importance given to each in arriving at an overall evaluation. From a statistical analysis of the replies, weighting the first, second and lower choices in the way that preferential ballots are usually counted, the considerations which carry the most weight in selecting a candidate for an engineering position, in the order of their importance, are as follows:

1. Personality

2.-3. Scholastic record; Indicated promise of development in specific field of engineering

4. Engineering experience
5. Evidence of ability to cooperate with others
6. Recommendations by qualified people
7. Indicated promise for executive development
8. Standing of college from which candidate was graduated
9. Salary requested

If only first choices are considered, the order of preference is somewhat changed, engineering experience ranking second instead of fourth, but personality still leads the list. Experience would no doubt rank higher and scholastic record lower, if it were not for the fact that the employment of recent graduates is uppermost in the minds of those seeking to increase their engineering forces.

Is the Present College Training of Engineers Satisfactory?

Eighty-three per cent voted yes, 14 per cent no. The predominant criticism of applicants for engineering employment by the 14 per cent were:

1. Lack of fundamentals—physical sciences and mathematics
2. Inarticulateness in speech and writing

3.-4.-5. Lack of education in the humanities; Lack of drafting and design experience; Lack of knowledge of economics and business

6. Lack of knowledge of operation and production

What is the Prevailing Policy in Regard to Starting Salaries and Advancement?

Twenty per cent of the cooperators indicated that every new engineer employee is regarded as a special case, and starting salary is based on his particular qualifications. The others were about equally divided between those who are influenced by prevailing rates in other companies and those who indicate that their salary scales are arrived at independently.

No company reports a starting monthly salary of less than \$150. and only four less than \$175. Five companies report starting salaries above \$250. The median (50 per cent level) is approximately \$207 per month.

In regard to advancement after initial employment, only 26 of the cooperators gave data. They were all within twelve industries, but none had enough data to indicate reliably consistent trend for the individual industry, therefore they were grouped and the average rate of advancement is approximately as follows:

Time of Advancement	*Minimum Percentage*	*Median* *Percentage Base-\$207*	*Median* *Actual*	*Maximum Percentage*
At the end of 6 months	2.5	8.0	\$16.60	14.3
At the end of 12 months	3.6	14.6	30.30	28.6
At the end of 18 months	7.5	24.2	50.00	42.9
At the end of 24 months	10.0	29.2	60.40	57.2

What is Done for Technical and Professional Development of Engineer Employees?

Only 50 per cent of the cooperators report that special provision is made for professional development of the young engineers in their employ, but practically all indicate that their engineering organization provides definite opportunities for professional advancement.

Thirty-seven per cent have formal training programmes for young engineers; 65 per cent indicate that

Table I

Summary of Significant Data from Survey of Employer Practice Regarding Engineering Graduates

Industries arranged in Groups according to Percentage of Engineers to Total Employees. Item 10

1 Group	A	B	C	D	Total and Averages Weighted by Indiv. Coopertrs.
2 Industries included	Colleges	Instrument Electrical Petroleum Chemical Aircraft	Machinery Building Paper Glass Utilities Metals Coal	Textiles Soap Rubber Automotive Shipbuilding Transport'n. Food	
3 Questionnaires sent out	10	47	74	43	174
4 Questionnaires returned	8	32	44	20	104
5 Questionnaires returned—%	80	68	60	47	60
6 Total Employees of Cooperators	4,785	438,874	788,408	780,994	2,013,061
7 Total Employees Reporting, both Total and Engrg. Grad. Employees	1,310	438,874	630,658	500,994	1,571,836
8 Engrg. Graduate Employees	585	21,252	9,333	2,588	33,758
9 Engineer Employees to Total—%	44.6	4.85	1.48	0.52	2.15
10 Range in % of Engrs. to Total Employees, when Grouped by Industries	44.6	6.6 to 3.9	2.0 to 1.0	0.9 to 0.3	44.6 to 0.3
11 Starting Monthly Aver. Salary—\$	198	208	210	204	207
12 Executives who are Engrg. Grad. % of Total Executives	70	41	48	23	42
13 Officers who are Engrg. Grad.—% of Total Officers	52	39	41	24	37
14 Engrs. Role in Development of Company "Very Important"—% Cooperators	100	90	77	65	80
15 Engrg. Grad. "Better Potential Opportunities" than other Employees with Comparable Education—% Cooperators	50	57	66	45	58
16 Opportunities for Future Advancement of Engrg. Grad. "Greater than Ever."—% Cooperators	86	57	64	42	59
17 Estimated Increase in Engrg. Grads. needed in next 4 years—% of Present Engineers	23	32	34	26	31

jobs are varied to provide a broad training; 41 per cent provide technical programmes within the company; 78 per cent encourage taking courses outside of company hours, and more than half of these contribute to the cost of tuition for such courses. (Some multiple choices are included in the foregoing percentages.)

Is Membership in Engineering Societies Encouraged?

Practically all encourage membership in engineering societies. Nearly 30 per cent pay the dues of certain employees in certain societies. Travelling expenses are usually paid by employers for attendance at meetings when employees are authorized to serve on committees, prepare papers, present discussion, and the like.

Need for Engineers During the Next Four Years

Item 17 of the Summary Table shows that over the next four years an average annual increase of about 8 per cent in the number of engineers was anticipated by the cooperators when they replied in June and July, 1946 to the questionnaire.

Conclusions

It is recognized by the Committee that the data are of limited scope, and therefore, should be accepted with some reservations.

This committee recommends to the Engineers' Joint Council that a better and more complete questionnaire be prepared and a more extensive survey be made along the line in which this trial survey was directed, in the near future, say the Fall of 1947.

PRESIDENT HAYES VISITS MARITIME BRANCHES

(*Continued from page 174*)

the plant, after which they called on the chairman of the branch, Colonel Johnny Angus Macdonald, who was at home recovering from a recent illness. The ladies were being entertained at tea by Mrs. Macdonald.

In the evening, while Mrs. C. M. Anson was hostess to the ladies for dinner at her home, the branch dinner meeting was held at the Navy League, under the chairmanship of C. M. Anson. The president was the principal speaker and was followed by G. J. Currie, Louis Trudel and W. S. Wilson.

After the meeting, the visitors joined the ladies at the home of C. M. Anson.

Antigonish

The morning of March 19th, the presidential party, accompanied by Vice-President and Mrs. Anson, left by motor for Antigonish where they arrived for lunch after an epic crossing of the Straits of Canso.

Reverend P. J. Nicholson, president, and Reverend W. P. Fogarty, M.E.I.C., professor of engineering, did the honours at St. Francis Xavier University. A. M. Macgillivray, an alumnus of St. Francis Xavier and a past-councillor of the Institute from Saskatchewan, now retired at Antigonish, joined the party at the university.

The group first had an opportunity of meeting with the students and were then shown through the buildings. Tea was served in the faculty dining room. During that time, the ladies were escorted by Mrs. D. J. MacNeil through the Mount St-Bernard Convent and went for tea to Professor MacNeil's home where they were later joined by the men, and the caravan got under way for Halifax.

Halifax

Like Ulysses returning to the fatherland after a long journey, President Hayes was given a great welcome in his own branch.

On the evening of March 20th, he paid a visit to Nova Scotia Technical College where the boys from St. Mary's College had joined with the local students to hear words of wisdom from the president. Dr. F. H. Sexton, retiring president of the college, expressed the welcome on behalf of the faculty who were all present and the students. President Hayes first presented the Institute prize certificate for 1946 to J. P. Oakley. He then addressed the student body, recalling his experiences across Canada and during his trip to England last September. His remarks concluded with three pieces of advice which were enthusiastically received. He was followed by Vice-President Anson who urged the students to remain in the Maritimes upon graduation and thus give their own province the benefit of their education, assuring them that local industry could use their talents. The assistant general secretary then spoke on the organization of the Institute.

The branch meeting at night took the form of a dinner in the Nova Scotian Hotel. Branch Chairman E. C. O'Leary presided and introduced the president.

Mr. Hayes expressed his satisfaction at the pleasant experiences which the discharge of his presidential duties had procured him. He recalled his trip across Canada and in England, and concluded with an outline of what he felt were the engineers' responsibilities in the future. He was thanked by Ira P. Macnab who praised very highly the manner in which President Hayes had discharged his duties.

The toast to the ladies was proposed by W. C. Risley and was very aptly responded to by Mrs. Hayes. Other speakers were C. M. Anson and Louis Trudel.

The meeting concluded with musical numbers rendered by local artists.

NOTICE TO STUDENTS

Student members of the Institute who are about to leave the university, whether definitely or only for the summer season, are requested to inform Headquarters of their new address, so that the *Journal* may be forwarded to them.

This is particularly important in the case of those who live in fraternities or boarding houses during the scholastic year. With present restrictions on the use of paper, it is imperative that no copies of the *Journal* go to waste.

Don't forget to inform us of your new address when returning to college in the Fall. Headquarters will change your mailing address as often as necessary provided you supply the information.

All changes should be recorded with the General Secretary, 2050 Mansfield St., Montreal 2.

As reported in the February *Journal*, the officers of the Institute entertained at luncheon on February 26th, Sir Frederick Handley Page, president of the Royal Aeronautical Society. The above photographs illustrate the occasion. On the left, left to right: (facing camera) Sir Frederick Handley Page; J. B. Hayes, president of the Institute; Dr. E. P. Warner, president of the Interim Council of ICAO. (Backs to camera) J. B. Stirling, councillor of the Institute; J. H. Parkin, National Research Council, Ottawa. On the right, left to right: Dr. J. J. Green, Air Transport Board; Sir James Cotton, head of the United Kingdom permanent delegation to ICAO; J. E. Armstrong, vice-president of the Institute, J. J. O'Neill, dean of engineering at McGill; W. A. Newman, head of research department, C.P.R.; F. P. Shearwood, past-president of the Institute.

CORRESPONDENCE

The Case Against " Free Designing "

Ottawa, March 12, 1947.

Dr. L. Austin Wright,
General Secretary,
The Engineering Institute of Canada,
Montreal, Que.

Dear Dr. Wright:

In the closing paragraph of his letter in the January issue of *The Engineering Journal,* Mr. Henry Jasen states that . . . " very frequently, structural engineers are not engaged for designing buildings in the province of Quebec, because material suppliers . . . furnish design drawings ". This state of affairs is not restricted to Quebec, nor is it restricted to the structural branch of the profession.

The blame for the condition lies chiefly with the architects, since most of the structural engineering, heating and ventilation, mechanical engineering etc., that is tied up with the design of a building, is put into the hands of the supply houses by them. The architects' code of practice states distinctly that no architect may permit any supply house to provide him with free engineering services; that if such service is supplied, the supplier shall not be allowed to bid on the work, except under conditions that will ensure competitive bidding.

In Ottawa, about 90 per cent of the work done by local architects is farmed out in this manner and, in consequence, architects who do abide by the rules are at a disadvantage, since they pay for such services. The result is that the consulting engineer finds himself compelled to cut fees by 50 per cent or more, in order to have some chance of competing against firms giving " free designs ".

I feel that much of the apathy towards this matter is due to the fact that in Ontario at least, most of the architects in Toronto abide by the rules, the consulting engineers get the work, and are, therefore, not interested in the problems of the smaller man outside that centre.

There is no objection to a supply firm carrying out design, provided that it is done by competent engineers, that a definite fee is charged for the work (whether or not that firm gets the contract), and that the seal of the responsible engineer is put on the drawings.

The supply house heads, in every case where I have discussed this matter with them, profess to deplore the present practice, and state they would be only too willing to discontinue it, " if the other fellow would do the same ".

Some time ago I wrote the Ontario Association of Professional Engineers suggesting that since the supply house heads profess to be of this mind, all that is needed is a conference to be called by the Association, to which supply representatives would be invited, to agree to an announcement that as of a certain date there would be no more free designing.

The Professional Engineers' Act, revised statutes of Ontario, 1937, chapter 237 as amended by 1946 chapter 75 states, " Each member of the Association shall have a seal . . . with which seal he shall stamp all official documents and *plans* ". That is the law of the land. Yet I know of no case where the plans prepared by a supply house bear the imprint of such a seal. I do know of many cases where plans prepared by supply houses have been used for the construction of buildings without it.

If the provincial associations could come to agreement, they have it in their power to advise their membership, that any engineer performing professional services for which he did not make a direct charge, or turning out any plan not bearing his professional seal, would be proceeded against, or be struck off the membership list. Drastic, certainly, but I am certain it would get results.

I consider that the Professional Engineers' Council under the powers vested in them by Section 32 (1) of the Ontario Act, should take action against supply house engineers, as being guilty of unprofessional conduct, even though the Council is not prepared to bring a charge of contravening the statutes.

The abolition of " free designing " will give the ultimate buyer a better job for less money. There will be an end to ' handbook engineering ', and the practising engineer will get better value for the Association fees he has to pay.

Yours faithfully

(Signed) H. B. Dickens, M.E.I.C.,
Consulting Engineer,
Ottawa, Ont.

EDUCATION FOR MANAGEMENT

Under this heading the Minister of Education for Great Britain has issued a report prepared by a special committee appointed by the government to study and recommend means by which adequate educational facilities for the study of management in industry and commerce could be provided.

The report has been in the possession of the Institute for some time, but it is only recently that it has been taken out of the "confidential" classification. The chairman of the committee is Lt. Col. L. Urwick, O.B.E., M.C., a world leader in this field. Readers of the *Journal* may recall that his article "Education for Management" appeared in the October, 1946 issue.

As a background for studying the work of the committee, Canadians should recall that some time ago the government announced that it had arranged some very substantial support to aid in the establishment of a British National Management Institute. This support takes the form of an annual contribution of £30,000 for a period of five years. The recommendations of the committee will be fundamental to the policy and operation of the Institute.

Incidentally, it is significant that British industry has also taken steps to advance the study of management. They have set up a staff college at Henley on Thames, and should be well into their programme by now.

It should be borne in mind that the terms of reference made specific mention of "the requirements of professional organizations and the need of their coordination". This explains the frequent reference to "multiplicity of courses" in the following paragraphs.

By way of arousing in the management student an interest in the report, and of providing some interesting information to the casually interested reader, the following excerpts are taken from different sections of the report:

"We have not been able to arrive at an accurate estimate of the number of persons engaged in managerial functions at the present time, as there are no statistics later than the 1931 Census to serve as a basis. Starting from these 1931 figures, however, and making allowance for the considerable changes that have taken place since, it can be estimated that between 400,000 and 450,000 persons in the United Kingdom are so engaged at the present time.

"If it is assumed that the working life of individuals discharging managerial functions is 35 years, an annual intake of some 12,000 recruits is required. It must be understood that this figure is no more than an estimate, in which allowance has been made for changes in the size and distribution of the working population since 1931, and that it is necessarily subject to a considerable margin of error, owing to the presence of factors whose significance cannot be accurately known. None the less, the figure is of an order of magnitude which shows the importance of the field of work under consideration.

"We wish to express our agreement with the Percy Committee on Higher Technological Education in its findings on 'management studies'. That Committee was 'impressed by the statement made by several witnesses, that the highly trained technician is often ignorant of the principles of industrial organization and management and that he often shows no inclination to accept administrative responsibility. Admittedly there is much in this field that can be learnt only from experience; but there is a body of knowledge, awareness of which may greatly facilitate the process of learning'.

"The art of conducting human systems of co-operation of many kinds has been a constant preoccupation throughout the ages. A valid distinction cannot be drawn between the study of management for one purpose rather than for another, nor is there anything new in the suggestion that management should be the subject of theoretical study.

"The channels through which the individual approaches managerial responsibilities are as varied as the intake into industry itself; they could not conceivably be made to correspond with any common educational background. Thus the future manager may be drawn from the boy or girl who leaves school at 15 or from the graduate who enters business between 22 and 25 years of age. While both may possess the same potential capacity for leadership and for exercising managerial functions, there is a marked disparity between their educational standards and immediate achievements. This leads to the core of the whole problem, the difficulty of providing a course of study suited to a wide diversity of needs.

"The pattern of recruitment to managerial posts has changed considerably over the last twenty years. Where previously appointments to such positions as Works Manager and Departmental Manager had been from among those who had achieved advancement from the ranks through the various foremen grades, the more recent employment of an increasing number of qualified engineers, chemists and so on has introduced a new class of competitors for such positions.

"We have examined statistics relating to three of the recognized professional institutions (2 engineering and 1 accountancy), the purpose of which was to estimate the extent to which men who had originally entered these professions had, during their careers, acquired managerial responsibilities. The figures for the three institutions, based on random samples, show a remarkable agreement, and demonstrate that in the course of their career some 70 per cent of these men engaged in 'managerial functions'.

"We believe that the practical results of this development (multiplicity of syllabuses) are likely to prove embarrassing to education authorities, on whom rests the responsibility for providing facilities for training in management. Some means should therefore be found of simplifying and assimilating the curricula devised by various professional bodies."

The report supplies a summary of the committee recommendations which is reproduced herewith. The report, itself, runs into about 15,000 words—all of them interesting—but making up a volume too large to reproduce in their entirety in the *Journal*. Here is the summary—

(1) That action is necessary if multiplication of courses in management is not to dissipate national facilities which are already inadequate. So long as each professional institution requires its own syllabus in this field, this must create difficulties for the teaching institutions.

(2) That the professional institutions should accept the obligation to include in their syllabuses as large a common management content as possible and confine specialized demands in this field to the essential minimum.

(3) That courses leading to qualifications in man-

agement should be limited to two stages, namely, "Intermediate" and "Final".

(4) That all Management Professional Institutions should adopt a common curriculum for the Intermediate course and that Technical Professional Institutions should adapt any management requirements in their syllabuses to this common curriculum.

(5) That the Intermediate course should consist of three parts—an Introduction to management, the "Background" subjects and the "Tool" subjects.

(6) That there should be two types of Final course, one for those who wish to qualify for management in some specialized field, the other for those who wish to qualify in general management.

(7) That the curriculum for the Final course in each specialized field should be prescribed in large part by the appropriate Management Professional Institution and that the curriculum for the Final course in general management should be prescribed by the appropriate national authority, but that Final courses of both types should contain certain common elements.

(8) That both Intermediate and Final courses should lead to qualifying examinations.

(9) That all professional institutions concerned should consider whether the syllabuses given in Appendices B and C are acceptable in broad outline as a basis for the action recommended above.

(10) That a student wishing to qualify in general management after qualifying in specialized management should do so only after an appropriate interval.

(11) That students should not begin a Final course in specialized management before the age of 23 or in general management before the age of 25. Special arrangements should be made for the older student.

(12) That students should not be expected to give more than 100 hours a year to formal part-time instruction at any stage of their courses. The possibility of granting day release should be considered.

(13) That statistical information should be collected and published on the need for men trained in management and the educational facilities available. A number of agencies should collaborate in this work.

(14) That immediate steps should be taken to secure an increase in the supply of trained teachers in management, both part-time and full-time.

(15) That an Advisory Council on Education for Management should, from the outset, be associated with the proposed Central Institute of Management.

(16) That a commission of enquiry should visit the United States of America to investigate and to report on the facilities for education in management in that country as compared with those provided in Great Britain.

MEETING OF COUNCIL

A regional meeting of the Council of the Institute was held at the Admiral Beatty Hotel, Saint John, New Brunswick, on Saturday, March 15th, 1947, convening at ten o'clock a.m.

Present: President J. B. Hayes (Halifax) in the chair; Vice-President C. M. Anson (Sydney); Councillors G. M. Brown (Saint John), G. J. Currie (Halifax), J. B. Stirling (Montreal), A. A. Turnbull (Saint John); General Secretary L. Austin Wright and Assistant General Secretary Louis Trudel. There were also present by invitation—Councillor-Elect C. D. McAllister (Saint John); Past-Councillors B. E. Bayne (Moncton), A. R. Crookshank (Saint John), J. P. Mooney (Saint John); R. M. Richardson, vice-president, E. G. Percy, councillor, and E. L. Ball, secretary, of the New Association of Professional Engineers of New Brunswick, V. S. Chestnut, chairman of the joint finance committee; L. O. Cass, chairman, J. M. M. Lamb, immediate past chairman, J. N. Flood and F. A. Patriquen, past chairmen, and K. W. Salmon, secretary-treasurer, of the Saint John Branch, C. D. Martin, of Halifax.

Honorary Memberships: Councillor Turnbull and Past Councillor Bayne were appointed scrutineers to open the ballot for honorary memberships. They presented their report which indicated that a unanimous favourable vote had been recorded. Accordingly, Dr. Ernest Brown, former Dean and Emeritus Professor of Civil Engineering at McGill University, Montreal, Dr. Percy Dunsheath, past president of the Institution of Civil Engineers, London, England, Dr. C. J. Mackenzie, President of the National Research Council, Ottawa, and Dr. F. H. Sexton, President of the Nova Scotia Technical College, Halifax, were declared elected honorary members of the Institute.

Canadian Council: Mr. Stirling stated that he would like to make an explanation to Council of the delay in dealing with some of the matters referred to his committee. This was due to the fact that the committee was made up of members located from Halifax to Vancouver. Last year it had been possible to hold three or four meetings at which all members except Mr. W. G. Swan, of Vancouver, had been present. He much preferred to have meetings of his committee rather than deal with the various items by correspondence, but it was not always possible to do so.

At the last meeting of Council a resolution from the Winnipeg Branch had been referred to his committee and he had replied to the secretary of the branch informing him that the matter was being considered and that a reply would be given to Council at the April meeting.

At the president's request, Mr. Stirling read the resolution and commented on the various items paragraph by paragraph. The resolution was a little difficult to understand but seemed to express support of the recommendation of the Committee on Professional Interests that a committee of presidents be set up rather than the Canadian Council of Professional Engineers and Scientists. Mr. Stirling pointed out that the Institute was definitely in favour of co-operation with other engineering bodies.

Mr. Richardson reported that as far as New Brunswick is concerned, both the Saint John Branch and the New Brunswick Association could see no need for a Canadian Council. At its recent annual meeting, the New Brunswick Association had confirmed its decision of a year ago that it could not support the Canadian Council in any way, financially or otherwise.

At this point, at the request of the president, Vice-President Anson took over the chairmanship.

Ontario Provincial Division: The general secretary reported that requests for the establishment of a provincial division had been received from a majority of the corporate members residing in Ontario. When he was in Toronto on February 22nd, the matter had been discussed with Vice-President Sisson, who had been appointed by Council at the last meeting as provisional chairman. It had been decided to call a meeting of Ontario councillors on Saturday, May 10th, immediately following the annual meeting of the Institute. This was noted.

Harry Bennett Educational Fund: Mr. Wright presented a brief report on the results of the campaign to date. The $25,000.00 objective has been reached but contributions are still coming in and most of the branches who have not yet reached their quota are hoping to do so. Ten branches have exceeded their quota.

Mr. Wright explained that the fund is in the hands of a Board of three trustees, operating under a trust deed approved by the Department of Finance. Mr. Wright outlined briefly the terms of the loan, the only requirement being that the applicant must be enrolled and in attendance at a university and must prove his need of assistance. No interest is charged while the candidate is at college, it being left to the trustees to decide whether or not interest should be charged after graduation.

Canadian Management Council: The general secretary reported that a series of meetings had been held at the Institute at which representatives of the several organizations interested in management had gathered to discuss the possibility of Canada participating in the forthcoming International Management Congress (Stockholm, July 3rd to 8th, 1947). The group had decided that membership in the international committee should be applied for and that a joint organization should be set up so that the membership could be conferred on one national body in accordance with standard practice for international organizations. This central organization does not have any activities beyond securing a membership on the international committee for Canada. The actual conduct of Canada's part in the meeting will be carried out by the original constituent organizations.

Mr. Wright explained that the same procedure was followed in the United States and in the other countries, too. In the States the organization was known as the American National Council.

After considerable discussion, it was agreed that in view of the fact that the new organization did not in any way usurp the powers of the constituent organizations, the Institute should join with the other Canadian societies in its establishment.

Definition of "Professional Employee": The general secretary presented a letter from the secretary of the Winnipeg Branch drawing Council's attention to an extract from *Engineering News Record* of February 13, 1947, which contained a definition of the term "professional employee" taken from a bill recently introduced in the United States Congress. The branch suggested that similar definitions could profitably be adopted by acts of the Canadian legislature.

Mr. Wright read extracts from the article and commented thereon. Following some discussion, in view of the fact that the functions of the National Labour Board lapse at the end of this month, it was unanimously agreed that the communication be acknowledged with the suggestion that any action along the line suggested should be taken through the provincial professional association.

At this point, President Hayes resumed the chairmanship.

Headquarters Staff Changes and Additions: The general secretary reviewed the situation at Headquarters pointing out that Mr. Trudel had resigned as assistant general secretary in order to take a position with the Shawinigan Water and Power Company. Thus, it became necessary to secure not only a field secretary and a technical editor for the *Journal* but also a new assistant general secretary. He reported that every Member and Junior of the Institute had been circularized and that several applications had been received. These are to be examined by the Finance Committee and interviews arranged with those whose qualifications seemed most nearly to meet the requirements.

The president expressed his own personal regret at the necessity of accepting Mr. Trudel's resignation. He explained that he had been in correspondence with Mr. James Wilson, president of Shawinigan, the outcome of which was that Mr. Wilson had agreed that Mr. Trudel could have leave of absence until after the annual meeting of the Institute. This kindness on behalf of Mr. Wilson was very much appreciated by Council and it was moved by Mr. Currie, seconded by Mr. Turnbull, and carried unanimously, that a vote of thanks be conveyed to Mr. Wilson.

In reply Mr. Trudel stated that it had been a very difficult decision for him to make and that it was only after "much deliberation and mental torture" that he had made up his mind to sever his connection with the Institute. He hoped and expected, however, to remain very active in the affairs of the Montreal Branch and he hoped also to take an active part in the annual meeting.

Student Conference: Mr. Wright reported that replies from five out of eleven universities had been received to his memorandum regarding the possibility of holding another student conference such as had been held at the time of the Institute's annual meeting in Montreal in February 1946. It had been suggested previously that for this year it might be advisable to hold an executive meeting of delegates residing near Toronto, but the replies received had encouraged the holding of a conference on a full scale. The conference last year had cost the Institute about $1200.00 and Mr. Wright wondered if the Council would be willing to give authorization to go ahead and hold the conference provided favourable replies were received from other universities.

Considerable discussion followed, during which Mr. Currie pointed out that the delegates to last year's conference had been the presidents of the engineering societies and as these boys had not returned to the university the following year the full benefit of their experience and enthusiasm had been lost. He suggested that if the delegates could be chosen from the junior year, possibly the vice-president of the engineering society, and continue at the university, it would be a great advantage.

Mr. Wright stated that this had been discussed on his last trip to the west, and he thought it very likely that at future conferences, the vice-presidents of the societies would be the delegates rather than the presidents. Following further discussion, it was unanimously agreed that Council approves in principle of the continuance of the engineering students conference.

Institution of Mechanical Engineers 100th Anniversary: Mr. Wright reported that Mr. J. Murray Fleming had accepted an invitation to go to London in June of this year to present a paper on the handling of bulk materials at the 100th Anniversary of the Institution of Mechanical Engineers.

Kelvin Medal 1947 Award: At Council's request the general secretary had endeavoured to secure suggestions of suitable persons who might be nominated by the Institute for the 1947 award of the Kelvin Medal. Several names were submitted and following considerable discussion it was unanimously agreed that no decision be made until the next meeting of Council.

The meeting adjourned for lunch at twelve thirty p.m. and reconvened at two fifteen p.m. with the president in the chair.

Western Professional Meeting 1934: The general secretary reported that a letter had been received from Past-President E. A. Cleveland which stated that an amount of $78.54 had been left over from the funds collected for the 1934 professional meeting held in Vancouver in association with the American Society of Civil Engineers. Dr. Cleveland, chairman, and Major Oliver, secretary, of the Institute's local committee, had agreed that the money should now be returned to Headquarters' general fund. The Finance Committee recommended that this money be accepted and that acknowledgment be made to Dr. Cleveland and Major Oliver. This was noted with appreciation and the Finance Committee's recommendation was approved unanimously by Council.

Institute Pension Fund: Mr. Turnbull stated that he had an item of new business for the consideration of the new Finance Committee which he thought might appropriately be brought up at this time. He suggested that consideration should be given to the establishment of a pension or annuity fund for the Headquarters staff. He did not know whether anything had been or could be done about it.

The president assured Mr. Turnbull that serious consideration had been given to this subject and asked Mr. Wright to explain just what the situation was. Mr. Wright pointed out that the matter had been investigated on several occasions and it had been found to be an expensive proposition. The finances of the Institute had not permitted it. Whether or not it would be possible to do anything under the increased fees he did not know, but he hoped that the matter was not closed. He hoped that it would be possible later to present to the Finance Committee for consideration some kind of a pension scheme for the staff. It was agreed that serious thought should be given to Mr. Turnbull's suggestion, and the matter was referred to the incoming Finance Committee for consideration and report.

New Brunswick Agreement: Mr. Wright reported on a meeting held the previous afternoon, at which he and Mr. Trudel, and Mr. Stirling, as chairman of the Committee on Professional Interests, had met the officers of the Association of Professional Engineers of New Brunswick. At that meeting it had been unanimously agreed to recommend certain amendments to the agreement in order to facilitate its operation, including the elimination of joint student membership.

On the motion of Mr. Brown, seconded by Mr. Turnbull, it was unanimously resolved that the proposed amendments to the co-operative agreement between the Institute and the Association of Professional Engineers of New Brunswick be approved, these amendments to be confirmed by an exchange of letters between the Institute and the Association.

In order to provide for the collection by the Association of the increase of $5.00 in the Institute annual fee for Members, on the motion of Mr. Stirling, seconded by Mr. Brown, it was unanimously agreed that Clause 3(a) of the agreement be amended by changing in two places the amount "$6.00" to "$11.00". This amendment had also been approved by the representatives of the two bodies at the meeting held on the previous afternoon.

Maritime Professional Meeting 1948: Considerable discussion took place as to the desirability of holding a maritime professional meeting in 1948. Mr. Cass had sounded out some of the members of the Saint John Branch who had all appeared to be in favour of such a meeting. Mr. Bayne believed the Moncton Branch would also be willing to co-operate. Mr. Turnbull suggested that St. Andrews would be an ideal location for such a meeting, possibly in the fall of the year, and he made a motion to that effect.

The president remarked that everyone seemed to be in favour of holding a maritime professional meeting at St. Andrews in the fall of 1948, the thing to be decided upon being the method of organization.

Mr. Turnbull suggested that if this Council approves of the suggestion it might be desirable for Headquarters to immediately make inquiries regarding hotel accommodation, and then correspond with the Saint John and Moncton branches. The Saint John branch could, on its own initiative or through Headquarters, get the approval of the New Brunswick Association and possibly the Nova Scotia Association and the Halifax and Cape Breton branches. In his opinion, the details of getting agreement between the associations and the branches would follow after Headquarters had obtained information about accommodation.

Following further discussion, Mr. Turnbull's original motion was revised, seconded by Mr. Brown, and carried unanimously as follows—that it is the sense of this Council that a joint maritime professional meeting should be held at St. Andrews in the fall of 1948, Headquarters to make immediate inquiries at the hotel and then communicate with the New Brunswick Association and the maritime branches.

Conference of Commonwealth Engineering Institutions: Mr. Wright reminded Council that at the Commonwealth Conference it had been agreed that all institutions represented there would make their publications available to members of the other bodies at the same price as paid by their own members. A letter had been received from the New Zealand Institute of Engineers advising that they have passed a resolution making their publications available to Institute members at the reduced rate.

On the motion of Mr. Brown, seconded by Mr. Currie, it was unanimously resolved that reciprocal privileges be accorded to the members of the New Zealand Institution of Engineers.

In response to an inquiry from Mr. Flood, Mr. Wright explained the reciprocal membership privileges are now in effect whereby members of one society may have six months complimentary membership with all privileges in any of the other societies without charge.

Canadian Construction Association: The general secretary presented a communication from the Canadian Construction Association which stated that it was the intention of the Association to make representations to the Dominion and provincial governments emphasizing the need for the preparation of detailed plans and specifications so that public works might proceed without delay when required by economic conditions. The letter suggested that the Engineering Institute and other bodies might be equally concerned with the situation which indicated that the present reserve of such works was totally inadequate to meet any serious shortage of employment.

The letter was supported by a report of the New Developments Committee of the Association, of which Mr. J. B. Stirling was chairman. This report was based on a survey made by the committee of the planning work already in hand by the provincial and federal governments.

The letter from the Association concluded with the request that the Institute forward copies of the report to other interested engineering bodies and suggested that such organizations might wish to forward appropriate resolutions to the Dominion and provincial governments.

After some discussion, it was agreed unanimously that the Institute endorses the resolutions of the Canadian Construction Association and their representations to the government. It was agreed that the report should be referred to the Committee on Professional Interests for action.

It was decided that the next meeting of Council would be held in Montreal on Saturday, April 12th. In view of the fact that the annual meeting of Council will be held at the Royal York Hotel, Toronto, on Wednesday, May 7th, it was agreed that at the April meeting, only routine business or items requiring attention before the annual meeting, would be on the agenda.

In closing the meeting, the president expressed the pleasure it had given him to attend a Council meeting in New Brunswick, and on behalf of the out of town councillors and guests expressed appreciation and thanks to the officers and members of the Saint John branch for their hospitality and many kindnesses.

The Council rose at four thirty p.m.

ELECTIONS AND TRANSFERS

A number of applications were presented for consideration, and on the recommendation of the Admissions Committee, the following elections and transfers were effected:

Members

Brockington, Hugh, B.Sc., (Mech.), Univ. of Wales, consultg. engr., Vancouver, B.C.

Bullock, Charlton Woodward, B.Sc., (Eng.) Univ. of London, jr. engr., Foundation Co. of Canada, Montreal, Que.

Cyma, Zygmunt Stanislaw, Mech. Engr., Politechnika Lwowska, Poland, chief plant engr., A. V. Roe Canada Limited, Malton, Ont.

DeWolfe, Harold Albert, B.Sc., (Mech.), Univ. of Maine, asst. mtce engr., Howard Smith Paper Mills, Cornwall, Ont.

Gibbons, James Fenton, B.Sc., (Elect.), New Brunswick, instructor, Canadian Vocational Training Rehab., Moncton, N.B.

Helyer, Maurice, structl. engr. and partner, McCarton & Nairne, Vancouver, B.C.

Libby, Hugh T., supt., gas distribution, B.C. Electric Co., Vancouver, B.C.

Millar, James Wallace, B.A.Sc., (Mech.), British Columbia, inspector, Dept. of Railways, Province of British Columbia, Vancouver, B.C.

Milne, Harrison Scott, B.Sc., Saskatchewan, resident engr., Defence Industries Limited, Petawawa Works, Chalk River, Ont.

Swanson, Robert Eugene, chief inspector, Det. of Railways, Province of British Columbia, Vancouver, B.C.

van Steenburgh, William Elgin, Colonel, R.C.A., MA.., Ph.D., Toronto, Director of Armament Development, N.D.H.Q., Ottawa, Ont.

Wilson, Morton Holmes, B.Sc., (Mech.), Queen's, works mgr., George White & Sons Co., London, Ont.

Transferred from the class of Junior to that of Member

Boyle, Thomas James, B.Sc., (Civil), Saskatchewan, asst. engr., Canadian Pacific Railway, Montreal, Que.

McColl, Bruce John, B.Sc., (Mech.), Queen's, chief, power plant section, design office, Canadair, Montreal, Que.

McNaughton, Andrew Robert L. Graduate, R.M.C., Kingston, president, Norcan Limited, Ottawa, Ont.

By virtue of the cooperative agreements between the Institute and the associations of professional engineers, the following elections and transfers have become effective.

Alberta

Member

Evans, Kenneth George, B.Sc., (Civil), Saskatchewan, hydraulic engr., P.F.R.A., Calgary, Alta.

Junior to Member

Cumming, Edwin Keith, B.Eng., (Mech.), McGill, lecturer, mech. engrg., University of Alberta, Edmonton, Alta.

Jones, David Carlton, B.Eng., (Mech.), McGill, jr. engr. and statistician, Canadian Western Natural Gas L. H. & Power Co., Calgary, Alta.

Saskatchewan

Members

Small, Frederick Lloyd, B.Eng., (Civil), Saskatchewan, design and inspecn. water and sewage works, Underwood & McLellan, Saskatoon, Sask.

Wells, Robert Bird, B.Sc., (Civil), Saskatchewan, jr. engr., P.F.R.A., Regina, Sask.

Student

Riemer, Paul, Univ. of Saskatchewan, Saskatoon, Sask.

Junior to Member

Gunter, Allan Nelson, B.Sc., (Chem.), Alberta, hydraulic engr., P.F.R.A., Regina, Sask.

Traynor, John Clair, B.Sc., (Civil), Saskatchewan, jr. engr., Underwood & McLellan, Saskatoon, Sask.

New Brunswick

Members

Gray, George Merrick, B.Sc., (Mining Engrg.), Toronto, supvr. constrn., D. O. Turnbull, consultg. engr., Saint John, N.B.

Williamson, W. A., B.A.Sc., (Elect.), Toronto, sales engr., Canadian General Electric, Toronto, Ont.

Junior to Member

McDermott, Arthur Gregory Paul, B.Sc., (Elect.), New Brunswick, asst. engr., New Brunswick Telephone Co., Ltd., Saint John, N.B.

Student to Member

Weyman, Charles Edward, B.Sc., (Civil), New Brunswick, estimator and constrn. engr., Coldwell Construction Co., Fredericton, N.B.

Nova Scotia

Member

MacInnes, Joseph, B.Sc., (Elect.), Nova Scotia Tech., asst. elect. supt., Dominion Steel & Coal Corp., Sydney, N.S.

Quebec

Members

Duff, Cameron Ferguson, B.Eng., (Mining), McGill, vice-pres. and genl. supt., Moldply Limited, Montreal, Que.

Schmelz, Herbert Felix, graduate, Polytechnical Institute of Vienna, mech. supt., Standard Machine Shop Ltd. Montreal, Que.

Sharpe, James MacDonald, B.Sc., (Elect. Engrg.), McGill, supt., system operating divn., Shawinigan Water & Power Co., Montreal, Que.

Junior to Member

Bourbonnais, George Valois, graduate, R.M.C., Kingston; B.Eng., (Civil), McGill, asst. consultg. engr., Z. Langlais, Quebec, Que.

Simons, Samuel John, B.A.Sc., Toronto, field engr., Ontario Paper Co., Ltd., (Quebec North Shore Paper Co.), Baie Comeau, Que.

Swift, John William, B.Eng., McGill, mech. engr., engrg. dept., Aluminum Laboratories Limited, Montreal, Que.

Thompson, Arthur McCall, B.Sc., (Elect.), Alberta, app. sales engr., Canadian General Electric Ltd. Winnipeg, Man.

Transferred from the class of Student to that of Member

Illaszewicz, Jerzy, B.A.Sc., (Mech.), Lwow Univ., Poland, mech. engr., E. B. Eddy Co. Parent, Que.

Zimmerman, G. Douglas, B.A.Sc., (Chem.), Toronto, district engr., Fischer & Porter, Montreal, Que.

Transferred from the class of Student to that of Junior

Hall, Kenneth Logan, B.Eng., Saskatchewan, lubrication engr., McColl-Frontenac Co. (B.C.) Limited, New Westminister, B.C.

Admitted as Students

Students at University of British Columbia

D. L. Armour	E. S. Hare	H. C. Redmond
G. E. Baardsen	J. Hayes	T. R. Reesor
J. M. Barron	R. C. Hermann	C. T. Reiser
R. A. Bath	S. Hodgson	A. F. R. Roberts
A. E. Baylis	A. V. Horie	W. E. Rolls
F. J. Bennett	E. B. Horne	F. Sampson
L. R. Bergklint	L. H. Hughes	A. R. Shrumm
M. J. Berson	F. E. Ives	G. E. Simmons
A. C. Boyd	C. W. Johnson	I. D. Smith
J. A. Brock	J. W. Kennedy	J. A. Smith
C. A. Brockley	W. F. Knight	H. E. Smyth
R. B. M. Brown	N. E. Kolbeins	J. E. Snowball
P. W. Browning	E. E. Long	A. G. Soderlund
R. M. Burmeister	D. S. W. Love	O. I. Solheim
B. J. Burns	J. A. H. Lund	J. A. Stewart
J. C. Cant	H. Maidment	R. R. Sume
R. S. Caulfield	E. Manuel	J. G. Sutherland
J. Collicutt	G. E. McAllister	R. A. Sutherland
R. D. Cowley	W. D. McCartney	P. Tassie
C. A. Crawford	A. I. Macdonald	H. Taylor
E. C. Cray	R. G. MacDonald	J. W. Thomas
T. G. Cundill	J. H. MacFadden	F. F. Toews
R. M. Cuthbert	D. J. McLennan	R. G. Tomkins
R. E. DeCou	R. D. McMahon	J. H. Toms
J. A. DeForest	G. M. McPherson	
D. D. Dennis	H. M. Mather	W. F. Tuff
L. L. Dennis	W. B. Miller	R. D. Urquhart
E. R. Dinsmore	F. R. Mullen	J. W. Warr
H. L. Donaldson	P. C. Nicolle	D. R. West
R. S. Dudley	R. F. Nikkel	C. S. White
R. L. I. Fjarlie	G. A. Noel	F. R. Whitley
S. G. Gardiner	M. T. Olsen	N. A. J. Williams
R. S. A. Glover	F. J. Otte	N. L. Williams
L. M. Gulley	W. T. S. Pearce	H. J. Wood
A. K. Hanson	M. R. Pyne	W. J. Wood

Students at University of Toronto

H. Dederer	H. M. Kolesar	H. N. Shoji
C. S. Dunn	M. M. Levene	F. Weinberg
J. A. Ellwood	A. J. Prell	S. S. Wier
F. H. Humphrey	W. G. Ratz	H. D. Young

Students at McGill University

R. V. C. Aitken	S. J. McNeily	G. R. A. Ramsey
J. Baumholz	E. M. Mosher	S. M. Sumka
H. P. Chamberlain	E. F. Nicolls	F. A. Tanel
J. J. Dussault	G. Ostry	W. H. T. Wilson
R. MacLellan	C. D. Purdy	

Students at Queen's University

H. G. Budowski	F. J. Johnson	J. K. Melville
D. G. Jamieson	G. King	F. W. New

Students at Nova Scotia Technical College

A. E. Burgess	W. G. R. Ivany	L. L. Spurr
J. A. Flood	T. B. McLennan	J. S. Stevens
R. Halfyard	R. T. Nolan	M. M. Williams
G. H. Hoganson	J. P. Oakley	

Students at University of Manitoba

G. F. Gillespie	A. E. Milne	H. Willms
A. G. McIntyre	R. B. Wiley	

Students at University of New Brunswick

D. E. Bastedo	J. D. McCrea	B. W. Shanahan
H. J. Baxter	C. S. McKinley	G. S. C. Smith
C. A. Gartley	C. L. Mofford	W. C. Watt
J. A. Marshall	G. C. Robinson	R. F. Weir
M. W. B. Martin		

Personals

News of the Personal Activities of members of the Institute

Charles E. Marlatt, M.E.I.C., has been elected chairman of the Kootenay Branch of the Institute. Born at Fort William, Ont., he graduated from Queen's University in 1923 with the degree of B.Sc. Immediately following graduation he was employed as topographer with the Department of Highways of British Columbia. He subsequently joined the engineering staff of the West Kootenay Light and Power Company as instrumentman in connection with the construction of the company's new hydro-electric plant. In 1926 he became employed by the Consolidated Mining & Smelting Company, Trail, B.C., and two years later was made superintendent of safety and fire insurance. He has been with the company since that time.

Mr. Marlatt joined the Institute as a Student in 1922, transferring to Junior in 1925, and to Associate Member in 1931. He became a Member in 1940.

Lloyd G. Scott, M.E.I.C., formerly with Greenlaw and Trott, consulting engineers, Winnipeg, Man., is now employed as plant engineer with Canadair Limited, Montreal.

A. Lloyd Huber, M.E.I.C., chief engineer of Link-Belt Limited, Toronto, has been elected a vice-president of the firm. He entered the employ of the company in 1929 and has served as district manager at Montreal.

Bruce O. Heron, M.E.I.C., has accepted the position of industrial engineer with the Industrial Development Bank at Montreal. He relinquished the appointment of executive assistant to the controller, The Inspection Board of Canada at Ottawa in February.

Jacques Drouin, M.E.I.C., is at present employed as service engineer with the Mathews Conveyer Company, Limited at Montreal.

William Storrie, M.E.I.C., of Gore and Storrie, consulting engineers, Toronto, has accepted appointment to a three-member Board of Engineers named by the City of Detroit to make a sanitary survey dealing with pollution of the Detroit River and Lake St. Clair in relation to Detroit's water supply.

R. F. Legget, M.E.I.C., associate professor of civil engineering, municipal and structural division, University of Toronto, has been named to head a division of building research being set up under the National Research Council.

Born in Liverpool, England, he graduated from the University of Liverpool in 1925 and received the degree of Master of Engineering from that institution in 1927. Professor Legget had extensive experience in construction engineering in Great Britain and on the Continent before coming to Canada in 1929 to join the construction division of the Power Corporation of Canada. In 1936 he became a member of the staff of Queen's University and later of the University of Toronto. He is a noted author having published many engineering papers and in 1939 a book entitled "Geology and Engineering" which deals with the application of the science of geology to the art of civil engineering.

The new Division of Building Research will work very closely with the Central Mortgage and Housing Corporation and will provide the required scientific data for an adequate programme in all fields of construction, including building materials, types of construction, layout and other essential features.

Sidney Hogg, M.E.I.C., was recently named general manager of West Coast Shipbuilders, Vancouver, to supervise reconversion of that company. Since going to Vancouver three years ago from Saint John, N.B., he has been chief engineer and general sales manager at Western Bridge and Steel Fabricators Limited, Vancouver.

E. Aboud, M.E.I.C., has joined Libby-Long Engineering Limited. The firm, now known as Libby-Long-Aboud Engineering Limited, is specializing in air conditioning, ventilation and heating engineering and contracting.

Thos. E. Storey, M.E.I.C., is the newly elected chairman of the Winnipeg Branch. A native of Brockville, Ont., he graduated from the University of Manitoba with the degree of B.Sc. in 1928. Following graduation he was employed by the City of Winnipeg Hydro-Electric System and in 1931 was made senior operator at their Slave Falls power house in charge of operation and maintenance. At the present time he holds the position of general superintendent in charge of production, City of Winnipeg Hydro-Electric System.

Mr. Storey joined the Institute as a Student in 1926. In 1933 he was transferred to Junior and two years later to Associate Member. He became a Member in 1940.

E. S. P. Braddell, M.E.I.C., is now with Trans-Canada Air Lines at Winnipeg, Man., as electrical and mechanical engineer on technical ground services. Until recently he was with Northern Electric Co. Ltd., as a power apparatus engineer in the general sales division at Montreal.

D. A. Chisholm, M.E.I.C., has resigned his position as resident engineer with the Department of Highways and Public Works of Nova Scotia. He has entered into a partnership with R. K. MacDonald and will carry on a general contracting business under the name of R. K. MacDonald Construction Company with head office at Antigonish, N.S.

Major R. B. Jennings, M.E.I.C., formerly inspecting engineer, Defence Projects Construction Branch, Department of Munitions and Supply, and latterly property engineer, War Assets Corporation, is now with T. Pringle and Sons, Limited, industrial engineers, Montreal, as general field supervisor.

A. L. MacDonald, M.E.I.C., is now employed as sales engineer with Watson Jack Co. Limited, Montreal. After serving throughout the war with the R.C.E., the R.C.A. Searchlight and Heavy Batteries, he joined the Inspection Board of Canada, Ottawa, as inspector of electrical engineering stores, which position he held until recently.

R. R. Colpitts, JR.E.I.C., has been appointed assistant mechanical engineer of the Canadian National Railways, with headquarters at Moncton, N.B. He was formerly with the Canadian International Paper Co. Ltd., at Dalhousie, N.B.

R. W. McNally, JR.E.I.C., is now employed in the Toronto office of the Mathews Conveyer Company, Limited, as a service engineer.

Obituaries

The sympathy of the Institute is extended to the relatives of those whose passing is recorded here.

William Joseph Bruce, M.E.I.C., died at his home in Lansing, Ont., on March 3rd, 1947. Born at Gamebridge, Ont., on January 6th, 1888, he attended the University of Toronto. After completing his civil engineering course he was employed for a time with the Canadian National Railways in Ontario and the western provinces on maintenance and construction. He was employed as assistant engineer in the Department of Public Works at Sault Ste. Marie, Ont., from 1913 until 1919 when he joined the Great Lakes Power Company as assistant engineer in charge of dredging and construction. He subsequently joined the staff of the International Power and Paper Company in Newfoundland and later worked for the Foundation Company of Canada Limited at Saint John, N.B., on reconstruction of wharves. On the outbreak of war, Mr. Bruce joined the Department of National Defence, air force division, to build air training schools at Windsor, Goderich and Port Albert, after which he joined the Allied War Supplies Corporation as supervising engineer of war plants at Ajax, Montreal and Windsor. After such war construction was completed he joined the staff of the Department of Public Works of Canada at Toronto, Ont., which position he held at the time of his death.

Mr. Bruce joined the Institute as an Associate Member in 1926, becoming a Member in 1940.

Earl John McIntire, M.E.I.C., died on November 23rd, 1946, after a lengthy illness. Born at Cleveland, Ohio, on December 24th, 1882, he first joined the Republic Iron and Steel Company in Youngstown, O., in 1899. Five years later he was made construction engineer of the company in complete charge of all construction work, building blast furnaces, open-hearth steel works, etc. In 1916 he went to Windsor to join the Canadian Steel Corporation Limited where he remained for ten years when he was employed by the Dinsmore Construction Company of Windsor. Mr. McIntire later became vice-president in the firm and the name of the company was changed to Dinsmore-McIntire Limited. Owing to poor health he had not been active in the firm for some months before his death.

Mr. McIntire joined the Institute as an Associate Member in 1920, becoming a Member in 1940.

News of the Branches

Activities of the Twenty-eight Branches of the Institute and abstracts of papers presented

ERRATUM

We regret that due to an oversight the following Halifax Branch report of meetings for 1946 was omitted from the general report published in the February issue.

HALIFAX BRANCH

During the year the Halifax Branch has held seven executive meetings, all of which were very well attended. Two of the main events in 1946 were the Annual Banquet held in conjunction with the Association of Professional Engineers of Nova Scotia and the Maritime Professional Meeting at the Pines in Digby. The meetings of the Branch were as listed below and attendance is given in brackets.

Jan. 29—Annual Banquet, held in conjunction with the Association of Professional Engineers of Nova Scotia. (274.)

Feb. 21—**Public Administration and Personal Experience with U.N.R.R.A.,** by John E. Lloyd, who had been special assistant to the director on the Bureau of Finance and Administration U.N.R.R.A. (56.)

Mar. 21—**Developments in Air Transportation,** by J. T. Dyment, Engineering Superintendent, Trans-Canada Air Lines. (65.)

April 15—**Atomic Energy,** by G. C. Laurence, Chief of the Technical Physics Division of the National Research Council's Chalk River Laboratory. (190.)

May 17—Luncheon tendered to Dominion Council by Branch executive—Speaker, E. Burke-Gaffney, President of Dominion Council.

Sept. 4-7—Maritime Professional Meeting held at the Pines Hotel, Digby, N.S., in conjunction with the other Maritime Branches and the A.P.E.N.S. and A.P.E.N.B. (274.)

Oct. 31—**More Power for Canada,** by William E. Ross, Canadian Manager of the Apparatus Department of the Canadian General Electric. (85.)

Dec. 19—Annual Meeting of the Halifax Branch. (40.)

EDMONTON BRANCH

W. W. Preston, Jr.E.I.C. - *Secretary-Treasurer*

The need for research on aircraft skis under the field conditions found in Northern Alberta, was explained by Mr. K. Korsak, engineer, of the North West Industries Ltd., Edmonton, when he presented a paper entitled **Design of Winter Landing Gear for Aircraft,** at a dinner meeting of the Edmonton Branch, on February 28th in the Macdonald Hotel. Mr. Korsak revealed that existing technical information provided by the National Research Council, was limited to higher temperatures than are usual in northern Alberta. It was obtained on flat landing fields, rather than the rough lake or river ice areas often used in this province. The speaker suggested that research might develop a truck type of landing gear, which was now impracticable, because of the excessive accelerations produced.

Lantern views of aircraft and design graphs were shown to illustrate current practice in ski design. Factors which must be considered include (1) sliding resistance, which depends on the dimensions of the ski and on the condition of the snow; (2) adhesion resistance resulting from stationary skis freezing to the snow; (3) wear resistance and (4) the performance of the aircraft necessitating streamlining to reduce drag, and shock absorbers to protect the undercarriage during landing. Mr. Korsak explained that the heat produced as a ski moves over snow produces water as lubrication. There is little resistance on hard snow, but considerable on wet snow. In low temperatures, a narrow ski is needed to increase the heat energy required to produce the water for lubricating the ski.

The speaker advocated the practice of attaching skis to the wheels of large planes because changes could be made easily, and because the tires absorbed much of the landing shock. However, the additional weight made this practice objectionable for small aircraft. For them, he recommended a light pedestal and a shock absorber, having an air cushion.

Chairman of the meeting, at which the attendance was 39, was J. W. Porteous. Mr. Korsak was introduced by J. E Cranswick, and at the conclusion of a lively discussion period R. M. Hardy proposed a well applauded vote of thanks.

HAMILTON BRANCH

L. C. Sentance, M.E.I.C. - *Secretary-Treasurer*
I. M. Macdonald, Jr.E.I.C. - *Branch News Editor*

The Hamilton Branch of the Institute held its regular meeting on Thursday, February 20th, 1947, at McMaster University, with 75 members and guests attending. E. G. Wyckoff presided, and announced the appointment of branch members, John Taylor, Wm. Hollingworth and Charles Waterous to Life Membership in the Institute. They have long been active in the Institute, the first two since 1908, and Mr. Waterous since 1896.

W. E. Brown introduced A. E. H. Fair, the evening's speaker, who is president of the Alliance Paper Mills, Toronto. Mr. Fair has spent 25 years in Canada's pulp and paper industry, and is well qualified to speak on the subject, and particularly the fine paper industry, in which he is most interested.

After sketching briefly the history of papermaking, which originated about 105 A.D. in China, Mr. Fair outlined the methods used today in the manufacture of both newsprint and fine papers. He then dwelt at greater length on new equipment in use and being developed, such as improved apparatus for removing bark from logs, and improvements in many other phases of manufacture.

New by-products are continually being extracted from the paper manufacturing process, some of which result in an improved paper, and all of which make the process more economical. Such things as pressboard and vanilla are recent by-products of the paper industry. Mr. Fair suggested that by-products may eventually become so important that paper itself will become a by-product of the process.

There is a shortage of trained technicians in the paper industry at present, said the speaker, but this can be remedied with the help of the universities in training men, and of engineers in placing them where they will be most useful. Mr. Fair urged the proper training of technical men, not only for paper manufacturing, but for the very important work of forest preservation and re-forestation as well. The future of the paper industry in Canada depends upon a sound forest policy; this policy is in the hands of the Government who can be assured of the co-operation of the pulp and paper industry.

Two very interesting colour films, tracing the history of paper making and describing modern pulp and paper making, were shown at the end of the address.

KOOTENAY BRANCH

E. B. Broadhurst, M.E.I.C. - *Secretary-Treasurer*

The Annual Meeting of the Kootenay Branch of the Institute was held in the Conference Room on February 21, 1947, with seventeen members present.

The results of election of officers for 1947 were announced.

Following routine business, a film entitled "The Freight Yard" was shown by A. H. W. Busby. The film dealt with New York Central's system of handling fast freight including classification of cars; types of cars; maintenance of cars and engines; type of locomotives assigned to trains depending on loads and speeds. The film gave an interesting insight to the complexities of our transportation problem.

LONDON BRANCH

A. L. Furanna, M.E.I.C. - - *Secretary-Treasurer*
G. N. Scroggie, M.E.I.C. - - *Branch News Editor*

A monthly meeting of the London Branch was held on February 27th in the Board of Education Board Room, with H. A. McKay presiding.

After reading a letter from J. H. Johnson, our past-chairman, who has been ill for the past few months, Mr. McKay introduced the speaker for the evening, Mr. V. S. Baker, who spoke on **Essential Links in Sanitation.** Mr. Baker is plumbing inspector for the City of London and secretary of the Ontario Association of Plumbing Inspectors and Affiliates. He is not only consulted about plumbing problems in other communities than London, but he journeys to various places here and in the United States, attending lectures and laboratory courses.

After giving figures of total costs to date of our water and sewerage systems, the speaker went on to point out the importance of a proper plumbing system as a connecting link between them.

Methods of testing by ball, water and smoke, the advantages and disadvantages of traps, the importance of proper back venting and cross connections, the problems of seepage and eave waters, and sewer gases were dealt with by Mr. Baker. He used carefully prepared drawings in such a manner that his attentive audience readily realized the necessity of proper plumbing methods to protect them as residents of this or any community.

During his talk a moving picture was presented which showed how submerged inlets and negative pressures could cause siphoning of possibly contaminated water from even a toilet bowl through a tap where water is drawn for human consumption. All too often this results in sickness and even in death.

Mr. Baker, citing specific instances of faulty plumbing, explained that often the plumbing system would conform to the code at the time of installation, but that the handy man would supplement the plumbing in a manner not in keeping with good practice. The speaker told of the high standards required of plumbers examined in London, the amendments he feels should be made in our by-laws, and stressed the need for re-inspection. It is hoped that the manufacturer will produce fixtures which will offer more protection to the public with such features as that important air gap that prevents siphoning from fixtures.

The speaker was thanked by W. M. Veitch who voiced the opinion of all present when he said that Mr. Baker is indeed an important civil servant to the City of London.

MONTREAL BRANCH

E. M. Van Koughnet, M.E.I.C. - *Secretary-Treasurer*

Montreal Branch Committees have been formed as follows:

- Programme—Emil Nenninger, Chairman.
- Membership—L. McGillis, Chairman.
- Admissions—J. A. H. Henderson, Chairman.
- Entertainment and Reception—C. A. Laverty, Chairman.
- Publicity—W. Sharples, Chairman.
- Student Guidance—G. B. Moxon and L. A. Duchastel, Joint Chairmen.
- House Committee—R. N. Coke, Chairman.
- Policy Committee—E. B. Jubien, Chairman.
- Branch Rep. Institute Nomination Com.—J. J. H. Miller.
- Junior Section—R. J. Griesbach, Chairman.

The Montreal Branch had an increase in membership last year of 302, bringing the total to 2,490. The membership has been showing an increase each year since 1932, and has almost doubled since 1939. This increase should be maintained in the coming years, especially if the many engineers who are not now members are encouraged to join.

The providing of Branch facilities to keep pace with this increased membership is one of the problems facing the Executive Committee. Accordingly the House Committee was formed to thoroughly examine the whole question. This committee will keep in close touch with the House Committee of the Institute which is presently looking into ways and means of taking care of the expanded programme of services at Headquarters. Since many of the facilities available at the Headquarters building are made use of by both the Institute and the Montreal Branch, the problems facing the two are closely related.

Another newly-formed committee is the Policy Committee, to provide a means whereby Branch policy may be examined and recommendations made to the Executive Committee for action. One of the first objectives of the committee will be to ascertain from the membership at large, the various functions that they feel it desirable for the Branch to fulfil, so that steps may be taken, before the end of the year, to broaden the field of Branch activities towards this end.

Over the last few weeks, members had the opportunity of hearing a number of interesting speakers at the regular Thursday evening meetings.

Colour films of the Bikini Test were shown and described by Air Vice-Marshall Stedman, one of the official observers. **Fluid Drives in Industry** was discussed by J. D. Roseborough. **How Trunk Water Mains Were Recently Re-Conditioned in Montreal** was described by F. Y. Dorrance. In a joint meeting with the A.I.E.E. and the I.R.E. members heard Dr. Harvey Fletcher discuss **Pitch, Loudness and Quality of Musical Tone.**

A successful Annual Smoker was held at the Mount Royal Hotel, and attended by over 300 members and their friends. We are indebted to Mr. Laverty for the excellent arrangements

Junior Section

"What concerns Juniors of the Institute?" That has been the question uppermost in the minds of the Junior Section executive in shaping the programme of the past year, and will continue to guide the activities of the Junior Section through 1947.

Film nights constitute a highly popular means of putting forward ideas and information and aid in keeping up with the forward march of industry and commerce.

Addresses before the Junior Section have ranged over a wide number of vital subjects providing a comprehensive picture of the fields explored. The 1947-48 programme is rapidly being mapped out and promises to provide many valuable evenings of profitable enjoyment throughout the coming session. The executive hopes that 1947 will see the Junior Section truly "come of age".

NIAGARA PENINSULA BRANCH

P. A. Pasquet, Jr.E.I.C. - - *Secretary-Treasurer*
C. A. O. Dell, M.E.I.C. - - *Branch News Editor*

On Thursday, February 27th, the Niagara Peninsula Branch of the E.I.C. held a joint meeting with the Association of Professional Engineers of Ontario at the Red Casque Inn on Highway No. 8, three miles from Niagara Falls.

The speaker for the evening was Dr. G. B. Langford, president of the Association of Professional Engineers, who was introduced by A. W. F. McQueen, councillor for 1945, and former classmate of Dr. Langford.

Dr. Langford gave an inspiring address touching on the high moral duty that engineers must assume as leaders in community and national life. He pointed out that all who receive higher education at the universities of this country pay only a small portion of the actual cost of their training, the remainder being borne by the people of the country as a whole, many of whom never have the opportunity to make direct use of the universities for themselves or their children. University graduates, therefore, have a duty to perform and should consider themselves as obliged to render service to their fellows by acting as leaders in the moral, intellectual, physical, and political development of the country to which they belong.

Dr. Langford reminded his audience of the pronouncement of another philosopher who said that the actions of men could be divided into three classes: those made under compulsion of law, those made under the free will of the actor, and those in between made partly by compulsion and partly by free will. The speaker pointed out that only as men advance in the realm of free will action do they attain toward true democracy. As their moral and intellectual standards advance, men are able to take free will action which will react to the benefit of the community as a whole, thus approaching a true democratic state. If, on the other hand, moral and mental development become such that more and more actions must be taken under compulsion of law, then society approaches the realm of dictatorship. Engineers today, through the moral and intellectual training which they have received and are receiving at the universities, have inherited a great responsibility which demands that they lead and continue to lead their fellow men toward true democracy.

Col. T. M. Medland, field representative of the Association of Professional Engineers, also addressed the meeting and answered many questions regarding the present status and progress of the Association.

Chairman W. D. Brownlee occupied the chair for the evening and others at the speaker's table were A. N. Conklin, councillor for the Association of Professional Engineers, and P. Buss, councillor of the Engineering Institute.

OTTAWA BRANCH

C. G. Biesenthal, Jr.E.I.C. - *Secretary-Treasurer*
R. C. Purser, M.E.I.C. - - - *Branch News Editor*

The first noon luncheon of the Ottawa Branch for the 1947 season was held at the Chateau Laurier on February 13th. At that time announcement was made of the presentation to thirty members of the Branch of life memberships in The Engineering Institute of Canada as of January 1st, 1947. Maj.-Gen. G. R. Turner, the new chairman, presided and made the announcement.

Among those granted such memberships were Charles H. Pinhey, who joined as a student member when the Institute was founded in 1887; A. J. Grant, charter member since 1891, and president of the Institute in 1930; and K. M. Cameron, president in 1943.

Others honoured were: James Adam, N. F. Ballantyne. Walter W. Benny, E. G. Cameron, R. deB. Corriveau, James Dick, J. A. Ewart, O. S. Finnie, G. H Ferguson, G. G. Gale, F. G. Goodspeed, George Kydd, J. E. Larochelle, J. G. Macphail, D. W. McLachlan, Victor Miche, W. H. Munro, F. H. Peters, G. W. F. Ridout-Evans, Frank E. Sterns, H. W. Swabey, Leslie R. Thomson, J. A. Wilson, Charles O. Wood. all of Ottawa; C. J. Chaplin, of Almonte; J. A. Freeland and A. K. Grimmer, both of Temiskaming; and John Handley, of Noranda.

Life Memberships had previously been granted to R. F. C. Alexander, F. Anderson, A. M. Beale, A. A. Belanger, S. J. Chapleau, M. F. Cochrane, H. M. Davy, T. H. Dunn, H. A. Dupre, B. F. C. Hoanel, W. S. Lawson, John Murphy, D. H. Nelles, L. H. Sherwood, and J. A. Stiles.

On behalf of the new life members, K. M. Cameron expressed their appreciation of the honour.

Announcement was also made by the chairman that consideration was being given to the formation of a junior section of the Branch, and of a women's auxiliary. Col. J. P. Carriere, chairman of the Programme Committee, outlined plans for the coming year.

Dr. L. Austin Wright, Montreal, general secretary of the Institute, who was present, spoke briefly on the affairs of the Institute, reporting that the membership now totals approximately 8,500.

A film, "The Story of Aluminum" was shown. The history of this metal was traced from the days when Napoleon III first startled his dinner guests with an aluminum table service. at a cost of more than $500 a pound, down to the present day.

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At a noon luncheon on March 6, Roy A. Crysler, of the Canada Cement Company Limited, described in an illustrated address the construction by his company of five double houses in Montreal, erected of concrete. A basic principle of their construction was that so far as possible no other material was to be used. One thing in particular that was cut out was the use of plaster, although a little was used in the kitchen and bathroom to conceal pipes and heating ducts in the ceilings.

This type of house was not really new, stated the speaker, and was not intended as an example of low-cost construction. The five houses were built in a row and when finished were painted in different colours presenting an attractive appearance. Portland cement paint was used to seal the walls, both inside and outside.

Outer walls were composed of double hollow concrete block walls with a two-inch space between filled with an insulating board compressed to that thickness. This board was also a cement product. The outer blocks were 4 in. thick and the interior blocks 6 in. thick. The wall between the houses also had a one-inch space between the double row of blocks filled with the board, the blocks on either side being 4 in. thick.

Floors had pre-cast concrete joists supporting 2 in. concrete slabs cast in place. To make the joists a plant had to be set up for that purpose by a Montreal firm under the direction of the company. All ceilings were left exposed. The " beamed " effect to the bedroom ceilings appeared rather unusual to some of the occupants but was not objected to after they were used to it. For the roofs and the ground floor temperature re-inforcements were used in erecting the slabs. On the bedroom floor slabs no re-inforcement was used.

Ceilings, walls and floors were painted to individual taste. Some of the prospective owners were dubious about the painted cement floors but soon got used to them. They found that the painted cement floors did not give them sore feet as they had expected. As a matter of fact, the women found them easy on the feet and easy to keep clean. A little wax now and then to protect the paint, that was all.

Wall ties were used while building the wall. All joints were carefully tooled and the speaker considered that an excellent job of block laying had been done. On each unit an endeavour was made to use a different joint for demonstration purposes. The roof was built dead flat.

Various features of the construction were illustrated by slides. All electric wiring was in the wall or in the slab, mostly the former. Plenty of base plugs were provided. The heating system was hot air, air-conditioned, fully automatic all the way through, equipped to change the air winter or summer. The furnace uses oil. Pipes for plumbing were exposed in the basement only, but were so placed as not to be in evidence. The basement besides having room for the furnace, laundry tubs and other features, provided space for a recreation room 13 ft. by 25 ft. in size.

Accurate costs were kept of the construction. The houses were not small and were in no way intended to be cheap. Not including the land the cost of construction was 63c per cu. ft.; with land and landscaping it was 67¼c for the completed job. These costs were not considered high for Montreal for this type of job.

Maj.-Gen. G. R. Turner, chairman of the branch, presided. The speaker was introduced by E. Viens, and thanked by A. C. Ross. Before the main address felicitations were extended to Dr. C. Camsell, recently awarded the Julian C. Smith medal of the Engineering Institute. Dr. Camsell was also elected president of the Canadian Institute of Mining and Metallurgy; and is also an honorary member of the American Institute of Mining and Metallurgical Engineers.

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At a joint evening meeting with the American Institute of Electrical Engineers on March 18th at the National Research Laboratories on Sussex street, J. R. Montague, assistant hydraulic engineer, Hydro Electric Power Commission of Ontario, gave an address on **Hydro Development on the Madawaska River.** Illuminating Engineering Society members were also present. The meeting was presided over by R. M. Prendergast and the speaker was introduced by M. J. McHenry. Thanks to the speaker were extended by Major-General G. R. Turner.

Illustrating his talk with slides and coloured motion pictures, Mr. Montague gave a complete story of the planning and the work done to date on the new power site near Stewartville. The Madawaska river, he said, has a possible peak when ultimately developed of 330,000 horse power.

The 81,000 horse power Stewartville development was begun in November, 1945, and it is expected will be completed early in 1948. The dam here will tower 200 feet above the present bed of the river. It will be 150 feet thick at the base and will taper to a thickness of 20 feet at the top. It will be 1200 feet long.

Diversion of the river around the main dam site while the dam is being constructed will be effected by a 30-foot tunnel through 750 feet of solid rock. Two coffer dams, one upstream from the site of the final concrete structure and the other below the site, will effect the diversion and keep the dam site itself unwatered during the main construction.

SAGUENAY BRANCH

J. E. Dyck, M.E.I.C. - *Secretary-Treasurer*

The History of Sulphuric Acid was the topic of an address given by W. H. DeBlois to the Saguenay Branch of the Institute on February 20th, 1947.

The speaker was wartime deputy controller of chemicals in the Department of Munitions and Supply and subsequently was appointed administrator of chemicals for the Wartime Prices and Trade Board. At the present time he is connected with the chemical group of Canadian Industries Limited and is one of this continent's leading authorities on sulphuric acid.

Mr. DeBlois discussed the production of sulphuric acid from its pioneer days when acid was made on a small scale and was consequently a costly product, up to the present time when 1,000 tons per day is produced in a single large plant. The first acid was produced on a commercial basis by the chamber process. When acid producers using this process began raising prices, research was stimulated and the contact process was introduced. Today both processes are used extensively. The chamber process will produce acid as high as 80 per cent strength while the contact process produces concentrated acid of 98 per cent strength.

The slides shown by Mr. DeBlois illustrated clearly the process, equipment and plant buildings involved in the production of sulphuric acid.

At the close of his address on sulphuric acid Mr. DeBlois discussed his wartime experiences as deputy controller of chemicals. One of his chief duties was to control the dispensation of chemicals which were vital to the war effort. This included products such as soda ash, pitch, glycerine, ethyl alcohol, fertilizers, quinine and penicillin. He mentioned also the complete co-operation that existed between his department and the War Production Board in Washington.

D. F. Nasmith thanked the speaker on behalf of the Branch.

SAINT JOHN BRANCH

K. W. Salmon, Jr.E.I.C. - *Secretary-Treasurer*
A. R. Bonnell, M.E.I.C. - *Branch News Editor*

The regular monthly meeting of the Saint John Branch was held Tuesday evening, February 18, in the Admiral Beatty Hotel, with L. O. Cass presiding.

The meeting was the first ladies' night of the season and a record number attended, there being 126 engineers and guests.

After refreshments and dinner, Charles Morrison of the Canadian General Electric Co. gave a very interesting illustrated talk on **The Magic of the Spectrum.**

Mr. Morrison began his talk with an outline of the history of light in relation to mankind, up to the time of the development of the incandescent lamp.

Mr. Morrison then went into detail on the spectrum, giving a demonstration on each band from ultra-violet to infra-red and radio waves. He spoke of the advantages of ultra-violet rays in hospitals, schools and public buildings in combating bacteria; and of the use of sodium vapor and mercury vapor lamps in street lighting. He told of the uses of polarized light, pointing out that " polaroid " is not used in automobiles at present due to the great amount of extra electrical power required for automobile headlights.

Mr. Morrison also demonstrated infra-red lamps for use in quick drying, and the use of black light on fabrics dyed with fluorescent material, showing where this method of lighting could be used to advantage in motion picture theatres.

He concluded his talk by showing the advantages of fluorescent lighting over the older methods of electric lighting

A vote of thanks was extended Mr. Morrison by R. M. Richardson and seconded by J. H. McKinney.

SARNIA BRANCH

F. F. Walsh, M.E.I.C. - - *Secretary-Treasurer*
J. E. Pickering, S.E.I.C. - *Branch News Editor*

On Thursday evening, February 20th, 1947, the Sarnia Branch of the Institute, in conjunction with the Sarnia Branch of the Chemical Institute of Canada held a dinner meeting in the Polymer Cafeteria. The guest speaker was Dr. Sidney E. Smith, president of the University of Toronto.

Gordon R. Henderson was chairman for the evening. He stated that the 147 men present represented the greatest gathering of technical brains in Sarnia's history.

As Dr. Smith rose to speak he was greeted by a rousing rendition of the Varsity yell. The subject of his address was **Canadianism.** He said we all tend to paint far too gloomy a picture of Canada's future and that we need " a greater faith and more passionate belief " in this country. Many think of Canada as a colony of Great Britain and an economic appendage of the United States. Yet two world wars have shown this to be untrue, and in them our youth has fought magnificently for this country. He gave scientists much of the credit for developing Canada, from a population of

4,000,000 in 1867 to the world's third greatest trading nation today, even though we rank 35th in population. He asserted, "it may be truly stated that our record since confederation is one of faith in social and Christian ideals".

Dr. Smith maintained that "in their very genesis, federations are very difficult nations to govern. There is always a tendency towards stress and strain and pulling between the central authority and the various component parts". Politicians of all parties tend to magnify these differences in order to gain votes. Yet, in spite of all these possibilities of friction ours is the only nation in North or South America which has never had a civil war. Our differences can be solved but a standard mould is not a good thing. He maintained that "democracy's unity is in diversity". Each part should fulfil its own objective with the national objective in mind.

As an example of the strength and unity obtainable through diversity Dr. Smith cited "the great polyglot that is Winnipeg". As president of the University of Manitoba from 1934 to 1944 and he had ample opportunity to observe Winnipeg. He maintained that we cannot point to one group of foreign origin in Canada which has not contributed something to this country. Prior to the last World War, 40 per cent of the enrolment of 4,000 at the University of Manitoba was not of Anglo-Saxon origin. The Winnipeg *Free Press* prints the New Year's greetings in 73 languages, yet nearly all people in these groups can read and write English. The movement of service personnel in Canada during the war was a great help in building understanding between various sections and groups.

In conclusion Dr. Smith urged those present to "exemplify in your thoughts, faith; in your words, wisdom; in your deeds, courage; and in action, service". In that way "we will go forward in a manner worthy of the destiny of this great country".

Dr. R. K. Stratford tendered the vote of thanks to the speaker and it was enthusiastically seconded by the audience.

TORONTO BRANCH

E. G. Tallman, m.e.i.c. - *Secretary-Treasurer*
E. R. Graydon, m.e.i.c. - *Branch News Editor*

The February meeting of the Toronto Branch was held on the 19th of the month, in the Physics Building at the University of Toronto.

Research in Ontario was the subject of the meeting, and the speaker, Dr. R. C. Wallace, chairman of the Ontario Research Commission, was well qualified to deal with it.

The meeting was arranged by the Engineering Institute in Toronto and, due to its appeal to all technical men, it was held under the auspices of the Affiliated Engineering and Allied Societies in Ontario.

An audience of some 220 heard Dr. Wallace, principal of Queen's University and a former president of the University of Manitoba and University of Alberta, tell of the work of the Commission and its findings. The speaker pointed out that the Commission's work was divided into five main classes, namely, industrial organizations, fisheries, soil husbandry, forests and mining. Thus a wide variety of problems were under consideration and practically every industry or group in Ontario could receive benefit from the Commission's work.

Discussion followed the meeting, and Dean C. R. Young, who as a member of the Ontario Research Commission had personal knowledge of Dr. Wallace's ability in the field of research, expressed the thanks of those present.

VANCOUVER BRANCH

Alan Eyre, s.e.i.c. - - - - *Secretary-Treasurer*
G. W. Allan, m.e.i.c. - - - *Branch News Editor*

On Monday, Feb. 17th, 1946, the Vancouver Branch of the Institute held its annual Students Meeting, with seventy members and students attending.

T. V. Berry, councillor elect of the Branch, presented The Engineering Institute of Canada award to Edward T. Kirkpatrick, last year's winner. This prize is presented each year to a student of any department of engineering who has proved himself most deserving, not only in connection with his college work, but also by his activities in the student engineering organizations.

J. P. Fraser, chairman of the Branch, introduced Stephen Herring, chairman of the Student Section, who acted as chairman of the meeting, and introduced the Speakers: F. J. Andrew, A. G. Fletcher, and R. Phillman, engineering students at the University of British Columbia. F. J. Andrew's subject was **The Use of an Ice Frozen Caisson in the Removal of Ripple Rock.** Ripple Rocks are situated in Seymour Narrows, one hundred and twenty miles north of Vancouver. The main rock is two hundred and twenty feet by one hundred and fifty feet, the lesser rock being one hundred feet by seventy-five. The minimum water coverage is six feet, while the maximum is twenty feet, with a tide current of twenty feet per second. Mr. Andrew reviewed briefly the various methods suggested in the past for the removal of the rocks, and talked at some length of working from a caisson frozen to the surface of the rock, describing the caisson, and the method of freezing the joint to the surface of the rock—an idea developed by James Lubzinki, a graduate of the University of British Columbia.

A. G. Fletcher chose as his subject **Logging Engineering** dividing his talk into four main headings: topography—reconnaissance—road construction—and the operation of truck logging. Mr. Fletcher in dealing with the construction of logging roads pointed out that the maximum adverse grade of five per cent, and a favorable grade of twenty per cent, with a minimum curvature radius of at least fifty feet, was generally used in truck logging roads. The skyline method of handling logs was discussed in some detail by the speaker.

The accuracy of the **One-Minute Transit** was the subject discussed by R. Phillman.

A very interesting discussion period followed the addresses, which indicated the general interest in the subjects, and a vote of thanks, enthusiastically endorsed by the audience present, was tendered by Jack Fraser.

VICTORIA BRANCH

S. H. Frame, m.e.i.c. - *Secretary-Treasurer*

On Wednesday evening, February 19th, the Victoria Branch held its second meeting of the year in the council chamber of the City Hall with Chairman R. C. Farrow presiding.

Major Farrow introduced the speaker of the evening, A. L. Carruthers. Mr. Carruthers is Deputy Minister of Public Works for British Columbia, previously being chief engineer and chairman of the Highway Board. He gave an enlightening and instructive address on **The Provincial Highway System** dealing with the physiography of the province as related to highways telling the difficulty in constructing east-west highways across north-west mountain ranges and rivers. He said the distance from Vancouver to Lethbridge was 872 miles by road but only 476 miles by air.

He dealt with "through versus local traffic" and contended that the number of persons using coast to coast roads in the United States was far below the number merely driving from town to town.

He mentioned a number of highway projects in British Columbia and said 441 miles of road were now under construction. A section of the Hope-Princeton road, he said, cost as much as $210,000 per 1500 feet.

Mr. Carruthers touched upon the history of British Columbia roads, paying high tribute to the pioneers for the excellent judgment used in locating their trails. He said many of them were perfectly situated and that a great number of our highways today follow the old trails as originally laid out.

Hon. E. C. Carson, Minister of Public Works, attended the meeting, along with representatives of bus lines, the Chamber of Commerce, corporation of B.C. Land Surveyors and the Victoria and Island Publicity Bureau.

At the close of his address the speaker was thanked by the chairman.

WINNIPEG BRANCH

R. T. Harland, m.e.i.c. - *Secretary-Treasurer*

Electrical Section

L. A. Bateman - *Secretary*
D. C. Bryden - - *News Editor*

The first annual meeting of the Electrical Section was held on February 13, 1947. H. L. Briggs, the chairman, outlined the activities during the past year and noted that the membership in the section is now 105, an increase of 40 during the year. The need for this type of meeting is demonstrated by the support of the members of the Winnipeg Branch.

S. S. Stevens, director of communications for Trans-Canada Airlines, addressed the meeting on **Electronic Aids to Aviation.** This subject proved most timely as he described in detail the method of blind landing that TCA is perfecting at the present time. Mr. Stevens provided the members with explanatory diagrams, and his talk provoked many questions.

Library Notes

Book notes, Additions to the Library of The Engineering Institute, Reviews of New Books and Publications

BOOK REVIEW

HEATING AND AIR CONDITIONING

6th ed. J. R. Allen, J. H. Walker and J. W. James, N.Y., London McGraw-Hill; Toronto, Embassy Book Company, 12 Richmond Street East, 1946. 667 pp., illus., diagrs., charts, tables, 9¼ x 6 in., cloth, $6.05 (in Canada).

Reviewed by W. H. Wilson, Jr.E.I.C.*

The latest edition of this book brings it completely up to date. Much of the text has been revised and some new material added. This text book is clearly written and sufficiently thorough to enable the student to obtain a solid theoretical groundwork, as well as some knowledge of practice. It contains a great many excellent illustrations, and several very good charts and graphs. However, the double page graphs bound into the book rather than being of the fly leaf type, lose some of their value, as the central portions are difficult to read.

The first chapter deals with the basic conception of heat, and the related physical properties of steam and air. There follows a discussion on heat loss from buildings, and methods of computing transmission coefficients for combinations of materials. Methods of heating buildings, and descriptions of various types of radiators, convectors, and unit heaters are given, including a timely section on the use and design of panel heating systems. Different types of fuels and boilers are discussed, and methods of firing are described with sections on mechanical stokers and oil burners. The manner in which boilers and furnaces should be selected is given. Various types of heating systems and their design is next dealt with, and a section is devoted to the description of piping materials and practice. Automatic controls and devices are described briefly and there is a short chapter on central and district heating.

The air conditioning section opens with a study of the properties of mixtures of air and water vapour, and the theoretical consideration of this subject is covered in some detail. Another chapter is devoted to the description of the various methods used for air conditioning in different types of buildings and a general description of the equipment used, including washers, fans, and filters. The transmission and distribution of air, friction losses, design and sizing of ducts and grilles, and noise levels are covered in some detail. The following chapter deals with methods of cooling and dehumidifying air, with a description of the apparatus used, and a section on the various types of refrigerants in common use. General considerations of the cooling and dehumidifying load are discussed, and a chapter is devoted to the design of an air conditioning system. There are several short chapters on residence air conditioning, unit air conditioners, and data on industrial air conditioning. The appendices deal with a more advanced study of the theory of air and vapour mixtures, sizes and ratings of radiators, the conductivity and conductance of various types of building construction, and a list of symbols used in drawings.

**Engineer, E. A. Ryan and R. A. Combe, Consulting Engineers, Montreal.*

ADDITIONS TO THE LIBRARY

TECHNICAL BOOKS, ETC.

Cities of Latin America; Housing and Planning to the South:
Francis Violich. N.Y., Reinhold, c1944. 241 pp., illus., cloth.

Control Charts in Factory Management:
William B. Rice. N.Y., Wiley; London, Chapman & Hall, c1947. 149pp., illus., cloth.

Current Waterworks Practice; a Practical Treatise on the Provision of Water Supplies for Urban and Rural Communities:
W. H. Maxwell. London, Batsford, 1946. 254 pp., illus., cloth.

Electronic Engineering Master Index; a Subject Index to Electronic Engineering Periodical, January 1935 to June 1945:
F. A. Petraglia, Editor. New York, Toronto, Macmillan 1946, 209 pp., cloth.

Elements of Mechanism; 6th ed rev:
Peter Schwamb, Allyne L. Merrill, and Walter H. James; Rev. by. Venton Levy Doughtie. N.Y., Wiley; London, Chapman & Hall, c1947. 428 pp., illus., cloth.

Engineering Practice; Volume 1; a Review of Modern Technique:
Henry Hirst. Melbourne, Engineering Practice, 1945. 159 pp., illus., cloth.

Handbook of Chemistry; a Reference Volume for all Requiring Ready Access to Chemical and Physical Data used in Laboratory Work and Manufacturing; 6th ed rev and enl:
Norber Adolph Lange, Editor. Sandusky, Ohio, Handbook Publishers, 1946. 1767 + 271 pp., tables, fabrikoid.

Heating and Air Conditioning; 6th ed:
John R. Allen, James Herbert Walker, John William James N.Y. and London, McGraw-Hill; Toronto, Embassy, 1946. 667 pp., illus., cloth.

Hydraulic Measurements; a Manual for Engineers; 2d ed rev & enl:
Herbert Addison. N.Y., Wiley, 1946. 327 pp., illus., cloth.

New City Patterns; the Analysis of and a Technique for Urban Reintegration:
S. E. Sanders and A. J. Rabuck. N.Y., Reinhold, 1946. 197 pp., illus., cloth.

Principles and Practice of Surveying; Volume 2—Higher Surveying; 6th ed:
Charles B. Breed and George L. Hosmer. N.Y., Wiley; London, Chapman & Hall, c1947. 674 pp., illus., cloth.

Radio Amateur's Handbook; 24th ed, 1947;
American Radio Relay League, Headquarters Staff. West Hartford, Conn., American Radio Relay League, c1947. 468 + 138 pp., illus., paper.

Sales Administration; Principles and Problems; rev ed:
Bertrand R. Canfield. N.Y., Prentice-Hall, 1947. 606 pp., illus., cloth.

Tables of Spherical Bessel Functions; Volumes 1:
Prepared by the Mathematical Tables Project, National Bureau of Standards. N.Y., Columbia University Press, 1947. 375 pp., tables, cloth.

Unionization of Professional Engineers and Chemists:
Herbert R. Northrup. N.Y., Industrial Relations Counselors, 1946. 52 pp., paper. (Industrial Relations Monograph No. 12)

War Diary of the English Electric Company Ltd., March 1938—August 1945:
London, English Electric Co. Ltd; St. Catharines, Ont., English Electric Co. of Canada Ltd., (1946). 255 pp., illus., fabrikoid.

PROCEEDINGS, TRANSACTIONS, ANNUAL REPORTS, ETC.

Canada. Department of Labour:
Labour Organization in Canada, Thirty-fifth Annual Report, 1945. Canada, King's Printer, 1947.

Corporation of Professional Engineers of Quebec:
Annual Report, 1946.

Ingeniors Vetenskaps Akademien. Handlingar: (Royal Swedish Academy of Engineering Sciences. Proceedings).
Nr. 189—Transient Recovery Voltage Subsequent to Short-Circuit Interruption with Special Reference to Swedish Power Systems, P. Hammarlund. Stockholm, 1946.

Junior Institution of Engineers:
Journal and Record of Transactions, Volume 56, 1945-46.

TECHNICAL BULLETINS, ETC.

Association of American Railroads and Edison Electric Institute:
Crossings of Electrical Supply Lines and Facilities of Steam and Electrified Railroads, August 1946. (Joint Engineering Committee Reports). (E. E. I. Pub. 0-12.)

Canada. Department of Mines and Resources. Bureau of Mines:

Peat Moss Deposits in Canada, Harald A. Leverin. Canada, Kings' Printer, 1946. (Bureau of Mines, No. 817)

Canada. Department of Mines and Resources. Dominion Water and Power Bureau:

Surface Water Supply of Canada; Pacific Drainage, British Columbia and Yukon Territory, Climatic Years 1940-41 and 1941-42. (Water Resources Paper No. 94)

Edison Electric Institute:

Specification for Marking and Arrangement of Terminals for Phase-Shifting Devices used in Metering; Approved by Committee on Metering and Service Methods Association of Edison Illuminating Companies and Meter and Service Committee, Edison Electric Institute. (MS-6:1946)

Electrochemical Society. Preprints:

91-5—Mechanism of Oxidation and Tarnishing, U.R. Evans.
91-6—Influence of Crystal Face on the Electrochemical Properties of a Single Crystal of Copper, Henry Leidheiser, Jr. and Allan T. Gwathmey.

Ohio State University. Engineering Experiment Station:

Bulletin No. 127—Ohio Stream Flow; Part II—Summary of Stream-Flow Records in Ohio, 1898—1944, C. V. Youngquist.

Princeton University. Industrial Relations Section. Selected References:

No. 14, March 1947—Union Security.

U. S. Geological Survey:

Professional Paper 209—The AJO Mining District Arizona.

STANDARDS, SPECIFICATIONS, ETC.

British Standards Institution:

Codes of Practice Committee:—*CP(B)631—Framed Partitions.*

...Standards:—*BS881 & 589:1946—Nomenclature of Commercial Timbers; including Botanical Names and Sources of Supply.—BS1339:1946—Humidity of the Air; Definitions, Formulae and Constants.*

...Yearbook, *1946.*

PAMPHLETS, ETC.

Applications of Electricity to Railways, 1942—1945; a Bibliography:

Edmund Arthur Freeman, and Douglas Rae Stephenson. Washington, D.C., Association of American Railroads, (1946).

Bibliography on High Frequency and Dielectric Induction Heating:

Staff Northwestern Technology Institute Library. Evanston, Ill., August 1946.

Everyman's Guide to Canada's Parliament:

George Hambleton. Toronto, World Affairs Pr. c1946. 63 pp.,

Freezeproofing Coal Shipments:

John F. Foster. Pittsburgh, Bituminous Coal Research, 1947. (Reprinted from Mechanization, v 11 n 1 Jan 1947)

Installation and Maintenance of Air Compressors:

D. Braid. Manchester, Emmott, 1947. (Mechanical World Monographs, 31).

Institution of Mechanical Engineers. Advance Papers:

Alternative Form of Pressure Vessel of Novel Laminar Construction, H. Birchall and C. F. Lake.
...Basic Principles of Automatic Control Systems, A. Porter.

Institution of Structural Engineers:

Approved Forms of Certificates of Payment.
...Examination Papers for the Graduateship and Associate-Membership Examinations held in January 1947.
...Form B—Form of Contract for the Engagement by the Architect of the Services of a Consulting Structural Engineer, rev 1946.
...Form of Tender, 1944.
...General Conditions of Contract for Structural Engineering works, 1944.
...Interim Report on Yield Point of Structural Steel and Steel Rods for Reinforced Concrete, 1944.
...Reinforced Concrete for Buildings and Structures; Report on Formulae for Computation of Stresses, 1946.
...Report on Steelwork for Buildings; Addendum to Part I—Loads and Stresses, 1942. op. cit.—Addendum (1946) relating to Arc Welded Construction.
...Schedule of Symbols Recommended for use in Structural Steelwork Calculations.

Salaries of Technical Persons:

Ottawa, Wartime Bureau of Technical Personnel, 1946.

Shawinigan Brieflets:

No. 1—Quebec Ready for Post-War, James Wilson, 1945.—No. 2—River Fights a War, Jack Paterson, 1945.—No. 3—Dam Building—25,000 B.C., I. D. MacKenzie.—No. 4—Engineering in the Development of Shawinigan, R. E. Heartz.

Solid and Buttress Dams with Stabilising Sloping Base:

Eugenio Diaz del Castillo. Madrid, Civil Engineering School, n.d.

Statistical Report on the Primary Textile Industry in Canada:

Prepared by the Statistics Branch, Research Division, Wartime Prices and Trade Board, –(1946).

Vertebrates from the Upper Moenkopi Formation of Northern Arizona:

S. P. Welles. Los Angeles, University of California Press, 1947.

War Effort and Organization of British Ship Repairing 1939-1945:

Lawrence Edwards. North-East Cost Institution of Engineers and Shipbuilders, 1947.

BOOK NOTES

The Institute does not assume responsibility for any statements made; these are taken from the preface or the text of the book.

Prepared by the Library of The Engineering Institute of Canada

APPLICATIONS OF ELECTRICITY TO RAILWAYS, 1942-1945:

Edmund Arthur Freeman and Douglas Rae Stephenson. Washington 6, D. C., Bureau of Railway Economics Library, Association of American Railroads, (1946). 87 pp., paper.

This booklet contains a classified bibliography of periodical articles appearing in a select-list of thirty-six periodicals, with an author index. References are arranged in three large groups by subject in chronological order. Bibliographies on Signaling and on Telegraph and Telephone are included as appendices. In the section "Key to Periodicals", it is understood that the files of foreign periodicals are not complete, but may be present for only a part of the year. The appendix contains lists of books and periodicals contributed by various sections of the Association of American Railroads.

BRITISH STANDARD SPECIFICATION FOR ACID RESISTING SILICON IRON PIPES AND PIPE FITTINGS. B.S. 1333-1946:

London, British Standards Institution, 1946. 2/-.

This new British Standard deals with the dimensions of high silicon pipes and pipe fittings from 1 inch to 12 inches nominal bore which are used in chemical plant and where excessive corrosion is inevitable or anticipated. Minimum silicon content to give maximum corrosion resisting properties is generally agreed to be 14.25%. Flanged pipes are specified with 45° cone ends for assembly by halved loose coupling flanges of ordinary cast iron impinging upon the 45° cone ends of the pipe. The Standard also deals with spigot and socket pipes, the spigots of which are generally similar to the ends of the cone and pipes, thus allowing inter-connection between cone end and spigot and socket pipes. The fittings included comprise elbows, bonds, tees and crosses for both flanged and spigot and socket pipes.

BRITISH STANDARD SPECIFICATION FOR AIR-DEPOLARISED PRIMARY CELLS. B.S. 1335-1946:

London, British Standards Institution, 1946. 2/-.

This specification prescribes the minimum rating of air-depolarised type primary cells on continuous discharge and gives the methods of test on which the rating is based. A system of nomenclature is prescribed by which the type and size of cell are expressed by a sequence of two or three letters and a number. Details of the quality of materials to be used, and also dimensions of electrodes, containers, connecting wires and terminals are also given.

BRITISH STANDARD SPECIFICATION FOR BLACK BOLTS AND NUTS (SMALL HEXAGON AND SQUARE) B.S.W. AND B.S.F. B.S. 916-1946:

London, British Standards Institution, 1946. 2/-.

The British Standards Institution has reissued B.S. 916 as the regular British Standard for black hexagon and square bolts and nuts for general engineering.

Because of the desirability of using the old large (Whitworth) size nuts in certain applications of heavy engineering work and in specially corrosive situations, consideration is being given to the reissue, for such applications of the table of Whitworth Standard nuts formerly contained in B.S. 28: 1932 (withdrawn in 1943).

BRITISH STANDARD SPECIFICATION FOR MANILA ROPES FOR GENERAL PURPOSES. B.S. 431-1946:

London, British Standards Institution, 1946. 2/-.

This revised standard (first published 1931) comprises three grades of manila rope "special", "standard" and "merchant" hawser laid (3 strand) shroud laid (4 strand) and cable or water laid (9 strand). Tensile breaking strengths of both yarns and ropes and weights of ropes are specified. The amendment to the 1940 edition of 13 additional clauses dealing with water repellent (water-proofed ropes) has now been incorporated.

BRITISH STANDARD SPECIFICATION FOR SISAL ROPE FOR GENERAL PURPOSES. B.S. 908-1946:

London, British Standards Institution, 1946. 2/-.

This revised standard (first published 1940) comprises one grade of sisal rope comparable as to strength with "standard" grade manila rope to B.S. 431, hawser laid (3 strand) shroud laid (4 strand) and cable or water laid (9 strand). Tensile breaking strengths of both yarns and ropes and weights of rope are specified. The amendment to the 1940 edition of 13 additional clauses dealing with water repellant (water-proofed) ropes has been incorporated.

BRITISH STANDARD SPECIFICATION FOR SOCKETS FOR WIRE ROPES FOR GENERAL ENGINEERING PURPOSES. B.S. 463-1946:

London, British Standards Institution, 1946. 2/-.

This revised standard (first published 1932) incorporates an existing amendment and corrects dimensions in Tables 1 and 2. The standard deals with both "open" and "closed" sockets for wire ropes from ⅞ in. to 5 in. circumference and provides for workmanship, tolerances, heat treatment and proof testing, while the Appendix gives a recommended method of socketing with white metal to B.S.643.

The following notes on new books appear here through the courtesy of the Engineering Societies Library of New York, and may be consulted at the Institute Library.

ADVANCED MATHEMATICS for ENGINEERS:

H. W. Reddick and F. H. Miller. 2 ed. John Wiley & Sons, New York; Chapman & Hall, London, 1947. 508 pp., diagrs., tables, 8½ x 5½ in., cloth, $5.00.

Assuming a knowledge of mathematics through the calculus, this book begins with the theory and standard methods of manipulation of ordinary differential equations. Succeeding chapters deal with various special functions, integrals, series and equations, with vector analysis, probability, and the operational calculus. To emphasize physical applications, problems are presented, with each principal topic, relating to the main fields of engineering. In this reviewed addition, an appendix has been added giving a brief discussion of dimensional analysis and systems of physical units.

DECIBEL NOTATION; Its Application to Radio and Acoustics:

V. V. Rao. Chemical Publishing Co., Brooklyn and New York; General Publishing Co., Toronto, 1946. 179 pp., diagrs., charts, tables, 8¾ x 5½ in., cloth, $3.75.

This book explains in detail the origin and development of decibel notation and describes a wide range of applications, with special reference to radio engineering and acoustics. Among the topics surveyed are the logarithmic unit, zero levels and level signs, decibel meter and decibel graphs, sound levels and phonic calculations. Since the book was originally published in India, the terminology is English rather than American, but the differences are few.

ENGINEERING PRACTICE; a Review of Modern Technique. Vol. 1:

H. Hirst. Engineering Practice, 359 Collins St. Melbourne, C.1, Australia, 1945. 159 pp., illus., diagrs., tables, 9⅛ x 7¼ in., fabrikoid, 25s.

First of a projected series dealing with the important aspects of present-day engineering technique, this volume covers the following topics: soldering of aluminum and its alloys; centrifugal casting of ferrous and non-ferrous components; properties and manufacture of bearings and bearing materials; forging of aluminum alloys; die casting. Intended for the Australian engineering industry, these articles review the technical literature and discuss developments of the last five years both in Australia and overseas. The connection between theory and practice is adequately stressed, and bibliographies are provided. Succeeding volumes will deal similarly with some five or six selected topics.

IMPROVING LONDON'S TRANSPORT:

Published by "The Railway Gazette", 33 Tothill St., Westminster, London, S.W.1, 1946. 108 pp., illus., diagrs., maps, tables, 12 x 9 in., paper, 5s.

Covering both surface and sub-surface lines, this publication opens with a brief historical discussion and an account of the scope and extent of the present works. Succeeding chapters cover subway construction work including special details, signaling practice, stations and buildings, escalators and lighting, new rolling stock, power supply and distribution, and traffic operation. The book is well illustrated by photographs, diagrams and maps.

INDUSTRIAL CARBON; its Elemental, Adsorptive and Manufactured Forms:

C. L. Mantell. 2 ed. D. Van Nostrand Co., New York, 1946. 472 pp., illus., diagrs., charts, tables, 9¼ x 6 in., cloth, $7.50.

This revision of a standard work has four sections: the elemental forms of carbon, the diamond, natural graphite, carbon black, acetylene black, lamp black and pigments, with their applications, form the first section; the second covers the adsorptive forms; the third section deals with the manufactured forms, artificial graphite, electrodes, brushes, arc-light carbons, specialties and resistors, materials of construction, porous forms, electronic tube anodes, and refractories; the fourth section includes analytical and testing methods, and physical and chemical properties. Many bibliographical references are included.

LONDON BUILDING LAW for the use of Architects, Surveyors and Students:

H. R. Chanter. B. T. Batsford Ltd., London, 1946. 358 pp., diagrs., tables, 9 x 6 in., cloth, 21s.

Intended as an introduction and guide to the various enactments and bylaws which affect building in London, this book provides a comprehensive digest of the essential requirements in the actual construction of buildings in that city. The book includes definitions and interpretations, design tables and calculations, and a historical review of London building law, in addition to the definite regulations on construction practice. Miscellaneous topics dealt with include illumination, noise, drainage, smoke, advertising signs, streets, area planning, etc.

SURVEYING; Theory and Practice:

J. C. Tracy. John Wiley & Sons, New York; Chapman & Hall, London, 1947. 1279 pp., illus., diagrs., charts, tables, 7¾ x 4¾ in., fabrikoid, $7.50.

Each branch of field work, as covered in Part I, is treated under three heads: the use of the instrument; the general method of procedure; the practical details of the field work. Part II explains general methods of office work, both drafting and computation, with emphasis on systematic procedure. Part III is a critical study of the construction and adjustment of instruments, with directions and suggestions for standardizing tapes. Part IV furnishes a working knowledge of requirements and procedures for special types of surveys, such as horizontal control surveys, aerial photographic surveys, etc.

USE of RESEARCH by PROFESSIONAL ASSOCIATIONS in DETERMINING PROGRAM and POLICY:

E. L. Brown. Russell Sage Foundation, New York, 1946. 39 pp., 9 x 6 in., paper, $0.25.

The weaknesses of program and policy determination for large professional associations by individuals or conference table methods are briefly discussed, and the use and value of research for these activities are shown by examples in actual association work dealing with professional training, salary and personnel practices, and the structure and function of the associations themselves.

PRELIMINARY NOTICE

of Applications for Admission and for Transfer

April 1st, 1947

The By-laws provide that the Council of the Institute shall approve, classify and elect candidates to membership and transfer from one grade of membership to a higher.

It is also provided that there shall be issued to all corporate members a list of the new applicants for admission and for transfer, containing a concise statement of the record of each applicant and the names of his references.

In order that the Council may determine justly the eligibility of each candidate, every member is asked to read carefully the list submitted herewith and to report promptly to the Secretary any facts which may affect the classification and selection of any of the candidates. In cases where the professional career of an applicant is known to any member, such member is specially invited to make a definite recommendation as to the proper classification of the candidate.*

If to your knowledge facts exist which are derogatory to the personal reputation of any applicant, they should be promptly communicated.

Communications relating to applicants are considered by the Council as strictly confidential.

The Council will consider the applications herein described at the May meeting.

L. Austin Wright, General Secretary

*The professional requirements are as follows:—

A **Member** shall have been engaged in some branch of engineering for at least six years, which period may include apprenticeship or pupilage in a qualified engineer's office or a term of instruction in a school of engineering recognized by the council. In every case a candidate for election shall have held a position of professionl responsibility for at least two years. The occupancy of a chair as professor, assistant professor, associate professor or lecturer in a faculty of applied science or engineering, shall be considered as professional responsibility.

Every candidate who has not graduated from a school of engineering recognized by the council shall be required to pass an examination as prescribed by council, on the theory and practice of engineering, with special reference to the branch of engineering in which he has been engaged.

A **Junior** shall have been engaged in some branch of engineering for at least four years. This period may be reduced to one year, if the candidate for election has graduated from a school of engineering recognized by the council, in which case he shall not remain in the class of Junior beyond the end of the eighth year after graduation.

Every candidate who has not passed the examinations of the third year in a school of engineering recognized by council shall be required to pass an examination in engineering science as prescribed by council. He shall not remain in the class of Junior beyond age thirty.

A Junior may be transferred to Member without payment of transfer fee providing he makes application before the end of the seventh year after graduation or, if a non-graduate, before attaining age twenty-nine, and his application is approved by council.

Council may extend the above limits if in its opinion special circumstances warrant such extension.

A **Student** shall be at least seventeen years of age, and shall present a certificate of having passed an examination equivalent to the final examination of a high school, or the matriculation of an arts or science course in a school of engineering recognized by the council or shall be required to write examinations as prescribed by the council.

He shall be:

a. pursuing a course of instruction in a school of engineering recognized by the council, in which case he shall be transferred to Junior automatically without payment of transfer fee in the second January after graduation, or

b. receiving a practical training in the profession in which case he shall be transferred to Junior without payment of transfer fee providing he makes application before attaining age twenty-five and his application is approved by council.

He shall not remain in the class of Student after he has attained the age of twenty-five, unless in the opinion of council special circumstances warrant the extension of this age limit.

An **Affiliate** shall be one who is not an engineer by profession but whose pursuits, scientific attainments or practial experience qualify him to co-operate with engineers in the advancement of professional knowledge.

The fact that candidates give the names of certain members as reference does not necessarily mean that their applications are endorsed by such members.

FOR ADMISSION

ABBOTT—ROSS HUGHSON, of Niagara Falls, Ont. Born at Lindsay, Ont., Jan. 21, 1914. Educ.: B.Sc., (Chem. Engrg.), Queen's, 1943. 1940, (summer), dftsman., Shawinigan Chemicals Ltd., Shawinigan Falls, Que.; 1941-42, (summers), dftsman, Horton Steel Works, Fort Erie, Ont.; 1943, (8 mos.), asst. chemist, Irvington Varnish, Hamilton, Ont.; 1943-45, zinc mill, inspecn. and quality control, Burgess Battery Co., Niagara Falls, Ont.; 1945 to date, dftsman., engrg. dept., North American Cyanamid Ltd., Niagara Falls, Ont.

References: S. R. Frost, A. Jackson, C. S. Boyd, W. R. Manock, L. C. Murtry.

BAIRD—SAMUEL LAWSON, of Trail, B.C. Born at Calgary, Alta., March 28, 1912. Educ.: B.Eng.,(Chem.), 1946 1931-32, mucking at collieries, Estevan, Sask.; 1932-37, (excep. 2 winters at Univ. of Manitoba), all types mill work incl. crushing, grinding, flotation, cyanide operation for Hudson's Bay Mining & Smelting; 1938-40, hoistman and i/c compressors for Buffalo Ankerite Gold Mines; 1940-45, Royal Canadian Navy, organized and selected present system of boiler feed water treatment used in Navy; Chief Engr. i/c of machinery and ship repairs on three Canadian Destroyers; at present, asst. to sr. research engr., on engrg. and research develpt., Canadian Consolidated Mining & Smelting Co., Trail, B.C.

References: E. Mason, A. C. Ridgers, S. C. Montgomery, C. E. Marlatt, J. V. Rogers, A. H. W. Busby.

BOLAND—RALPH WILLIAM, of Cornwall, Ont. Born at Brimley, Mich., Aug. 15, 1903. Educ.: I.C.S. course in mech. dftng; British Institute of Tech. course in mech. engrg.; 1925-30, dftsman., St. Maurice Paper Co.; 1930-40, chief dftsman., Anglo-N'fld. Development Co.; 1940-42, chief dftsman., Consolidated Paper Corp.; 1942-44, mech. supt., Defence Industries Ltd.; with Howard Smith Paper Co., as follows: 1944-45, chief dftsman., 1945 to date, sr. designer, i/c of group of men working on an extensive constrn. programme, Cornwall, Ont.

References: E. Butler, C. H. Jette, H. S. Windeler, F. M. Pratt, P. A. Frattinger, I. J. MacPherson, H. E. Meadd.

BOWLES—GEORGE WILLIAM, of 5411 Coolbrook Ave., Montreal, Que. Born at Winnipeg, Man., April 14th, 1915. Educ.: B.Sc., (Elect. Engrg.), Manitoba, 1936; 1937-38, elect. dftsman, Square D C., Toronto. Ont,; 1938-40, jr. elect. engr., Amalgamated Electric Corp. Ltd., Toronto, Ont.; 1940-44, with Defence Industries Ltd., as follows: 1940-41, elect. dftsman, responsible for design and layout of lighting and power instlns. power house and transformer substn. layout, designing and planning special control systems, etc., 1942, elect. supt., Villeray Fuze Plant, acted as elect. constrn. supt. during time of constrn., responsible for all elect. work incl. H.T. switching and main transformer bank, etc., 1942-44, mtce. supvr., responsible for efficient and safe operation of steam plant, mech and elect. equipt.; 1944-45, elect. inspectg. officer, British Admiralty Tech. Mission, Ottawa; 1945-46, elect. engr., War Assets Corp., Montreal; 1946 to date, elect. engr., Howard Smith Paper Mills Ltd. Cornwall, Ont.

References: W. H. Wharton, W. G. Scott, G. R. McLennan, J. R. Auld, H. C. Karn, A. G. Moore.

DESCHENES—ALBANA MIVILLE, of Montreal, Que. Born at Sayabec, Que., June 10, 1923. Educ.: B.Eng., (Civil), McGill, 1946; 1945-46, (summers), observer on primary and secondary triangulars, Geodetic Service of Canada; at present, design work on concrete and steel structures, Robert A. Rankin Co. Montreal, Que.

References: R. E. Jamieson, F. M. Deschenes, J. L. Rannie, R. DeL. French, R. J. Merrit.

ELLIOT—JAMES MUNRO, of Cornwall, Ont. Born at Liverpool, England, Nov. 8, 1918. Educ.: B.Sc., (Mech.), (External), Univ. of London, 1937; 1934-37, special apprent., Yorkshire Copper Works Ltd., Leeds; with Mather & Platt, Ltd. Manchester, as follows: 1937-38, special apprent., 1939-40, consultg. engr., genl. engrg. sales dept., inspecting installed machinery, and advising customer on new requirements; 1940-45, Royal Engineers and Royal Navy, Commissioned into Royal Engineers, O/C Workshop Companies in India, Burma and Africa; 1945-47, chief engr., Industria Colombiana de Rayon, Barranquilla, Colombia, S.A.; at present, mech. design and consultg. engr., R. A. Ranking & Co., Montreal, Que.

References: E. J. Bartley, C. B. McRitchie, R. A. Rankin, H. Schmelzer, G. G. Eastwood.

FITZPATRICK—LOUIS FAIRLIE,, of Shawinigan Falls, Que. Born at Haileybury, Ont., March 21, 1921. Educ.: B.Eng., (Chem. Engrg.), McGill, 1943; 1940-41,42, (summers), chainman, Foundation Co.; lab work, Donnacona Paper Co.; machinist's helper, Canadian Industries Ltd., Brownsburg, Que.; 1943-44, Lieut., Royal Canadian Engineers; 1945 to date, plant operations dept., process supervision, Shawinigan Chemicals Limited, Shawinigan Falls, Que.

References: J. S. Whyte, H. K. Wyman, M. Eaton, L. A. Robillard, R. W. Fugler, A. B. Balcom.

GAGLIARDI—SAMUEL, of Montreal, Que. Born at Victoria, B.C., March 5, 1924. Educ.: B.A.Sc., (Mech.), British Columbia, 1946; 1943-44-45, (summers), mach. helper, Victoria Machine Depot, Yarrows Ltd.; 1946-47, dftsman., Victoria Machine Depot, Victoria, B.C.

References: W. J. MacKenzie, H. J. MacLeod, A. Peebles, J. N. Finlayson, G. M. Tripp.

HARRIS—JACK EDWARD, of Sarnia, Ont. Born at Vancouver, B.C., Sept. 12, 1915. Educ.: B.A.Sc., M.A.Sc., (Chemistry and Physics, British Columbia, 1938 and 1942, respectively; R.P.E., Ontario; 1938-40, engr., supvng. analytical and testing lab., Canada Roof Products; with Dow Chemical of Canada Limited, Sarnia, Ont., as follows: 1942-46, instrument engr., in direct charge of instruments of elect. dept., 1946-47, mtce. engr., i/c of all mtce. and mtce. engrg., at present, works engr. i/c all mtce., services and engrg. (incl. constrn.) for Dow plants in Sarnia.

References: A. E. C. Slater, G. R. Henderson, B. B. Hillary, F. F. Walsh, E. W. Dill.

LIGERTWOOD—HENRY CORMACK GRANT, of Seven Sisters Falls, Man. Born at Aberdeen, Scotland, Sept. 23, 1896. Educ.: B.Sc., (Civil Engrg.), Manitoba, 1924; 1915-23, (summers), rodman Greater Winnipeg Water District; dftsman., Bridge Engr.'s. Office, Canadian National Railways: dftsman., Manitoba Power Co., Winnipeg; instru'man. Walbridge Aldinger Co., Detroit, Mich.; 1924-26, instru'man and inspectr., Bridge Engr.'s. Office, Canadian National Rly.; Winnipeg; 1926-31, office engr., Manitoba Power Co. and Northwestern Power Co., Winnipeg; 1932-33, sales engr., Canada Ingot Iron Co., Regina, Sask.; with Winnipeg Electric Co., Winnipeg, as follows: 1937-38, engr. i/c constrn. of transmission line, 1939-46, res. engr., i/c concrete repair work, 1946 to date, constrn. engr.

References: E. V. Caton, L. M. Hovey, C. P. Haltalin, E. P. Fetherstonhaugh, C. H. Attwood.

MALCOLM-MERWIN E., of Smith's Falls, Ont. Born at Coboconk, Ont., July 20, 1914. Educ.: B.A., Toronto, 1938: 1928-38, (summers), rodman, jr.

(*Continued on page 198*)

Employment Service

The service is operated for the benefit of members of The Engineering Institute of Canada, and for industrial and other organizations employing technically trained men—without charge to either party. It would therefore be particularly appreciated if employers would make the fullest possible use of these facilities to make known their existing or estimated requirements. Notices appearing in the Situations Wanted column will be discontinued after three insertions, and will be re-inserted upon request after a lapse of one month.

Situations Vacant

CHEMICAL

CHEMICAL ENGINEER OR CHEMIST interested in textile dyeing, required by an industrial firm in South Western Quebec. Salary open. Apply to File No. 3798-V.

CHEMICAL ENGINEER, with pulp and paper experience, required by a firm of consulting engineers in Montreal, for design and research. Salary according to experience. Apply to File No. 3799-V.

CIVIL

SEVERAL CIVIL ENGINEERS, with two or three years' experience in road construction required for road building work in Northern Quebec. Salary open. Apply to File No. 3804-V.

ELECTRICAL

ELECTRICAL ENGINEER required for power sales by an electrical utility in Province of Quebec. Preferably experienced. Bilingual. Salary open. Apply to File No. 3802-V.

ELECTRICAL ENGINEER, recent graduate, required in central engineering department of industrial organization in Montreal. Duties include development, design and installation. Permanent position. Salary $175 up. Apply to File No. 3807-V.

MECHANICAL

MECHANICAL ENGINEERS required by a Pulp and Paper mill at Powell River, B.C. Preferably with experience in plant design in the pulp and paper industry. Salary according to qualifications. Apply to File No. 3796-V.

MECHANICAL ENGINEER, 35-40, with steel, copper or brass mill experience, required to take charge of a small engineering department for a firm in Montreal making rock metal. Salary $350 up. Apply to File No. 3800-V.

MECHANICAL ENGINEER required to establish and operate an estimating and planning department for the grinding and machine shop of a firm located in Central Ontario. Experience in tools, dies, and shop work essential. Salary open. Apply to File No. 3801-V.

MECHANICAL DRAUGHTSMAN, with several years experience in machine design, required by an industrial organization in Montreal. Salary $250 up. Apply to File No. 3807-V.

MECHANICAL ENGINEER with at least 10 years experience in design and installation of machinery also supervisory ability required by an industrial organization in Montreal, Salary open. Apply to File No. 3807-V.

MISCELLANEOUS

INDUSTRIAL ENGINEER, with two to five years experience in time-study and job evaluation required by a firm in Montreal making rock metal. Salary $200 up. Apply to File No. 3800-V.

GRADUATE CIVIL OR MINING ENGINEER required to take charge of several small instrument parties, for layout work in New Brunswick area. Salary $350. Apply to File No. 3803-V.

MECHANICAL AND ELECTRICAL ENGINEER required by a consulting engineer in Montreal for service engineering. Preferably with design experience in heating and ventilating. Salary $225 up. Apply to File No. 3805-V.

CHEMICAL OR MECHANICAL ENGINEERS, recent graduates, required by an organization in the Montreal area, for experimental and development work, with view to supervisory positions in production. Salary $200 up. Apply to File No. 3806-V.

ENGINEERING DRAUGHTSMEN, required by large transport company in Montreal for work leading to design. Salary $200 to start. Apply to File No. 3809-V.

BRIDGE INSPECTOR required by a large transport company in Montreal area. Salary open. Apply to File No. 3809-V.

RECENT GRADUATES OR JUNIOR ENGINEERS with mechanical background, required by a Montreal Engineering, fabricating and contracting firm for training purposes leading to sales and service. Area Montreal. Salary $175 up. Apply to File No. 3810-V.

STRUCTURAL ENGINEER, required by a firm of consulting engineers in Montreal for design work. Must have experience in structural steel and reinforced concrete. Salary open. Apply to File No. 3811-V.

The following advertisements are reprinted from last month's Journal, having not yet been filled.

CHEMICAL

CHEMICAL ENGINEER OR CHEMIST, preferably with Ph.D., required by a pulp and paper company with plants in Eastern Canada, for research work. Salary open. Apply to File No. 3549-V.

CHEMICAL ENGINEER required by a pulp and paper company with plants in Eastern Canada, for mill control and pilot plant work. Salary open. Apply to File No. 3549-V.

CHEMICAL ENGINEER required by a petroleum refining company in Montreal for process and design work. Salary about $225. Apply to File No. 3575-V.

CHEMICAL ENGINEER required as assistant professor of chemical engineering in a Canadian university to start autumn 1947. Salary open. Apply to File No. 3600-V (D).

CHEMICAL ENGINEERS OR CHEMISTS for analytical work in the laboratory of an industrial firm in Central Ontario. Salary from $175. Veteran preferred. Apply to File No. 3642-V.

CHEMICAL ENGINEER, preferably with sales experience, for sales and service with an industrial firm in Central Ontario. Salary open. Apply to File No. 3642-V.

CHEMICAL ENGINEERS, both with experience and recent graduates, required by an industrial organization in the St. Maurice Valley. Salary open. Apply to File No. 3644-V.

CHEMICAL ENGINEER recent graduate up, to be assistant to the department superintendent of a tar distillery in the Toronto area. Salary $225. Apply to File No. 3674-V.

CHEMICAL OR METALLURGICAL ENGINEERS, from recent graduates up, required by a Quebec firm engaged in metal production for employment as production and development engineers. Salaries open. Apply to File No. 3693-V.

CHEMICAL ENGINEER, recent graduate, required as process engineer in production control by a manufacturer in Central Ontario. Salary open. Apply to File No. 3708-V.

JUNIOR CHEMICAL ENGINEER required for the control department of a paper mill in Shawinigan Falls. Salary from $175-$275. Apply to File No. 3765-V.

GRADUATE CHEMICAL ENGINEER required by a Montreal firm to supervise and control Chemical plant engaged in production of fine chemicals about 60 miles from Montreal. Preferably with actual experience in handling both laboratory and plant personnel. Salary open. Apply to File No. 3783-V.

CHEMICAL ENGINEER with knowledge of how to treat sulphate or failing this sulphite and soda pulp, required as Regional Manager by a large paper company in Northern Ontario. Executive and management ability necessary. Permanent position. Salary $15,000. Apply to File No. 3808-V.

CIVIL

CIVIL ENGINEER with experience in the mechanical trades required as designer by a building contractor in Quebec, age 30-35, salary open. Apply to File No. 3444-V.

CIVIL ENGINEER to take charge of work in a drainage district in Quebec. Must be bilingual. May be recent graduate. Salary from $200. Apply to File No. 3479-V.

CIVIL ENGINEER for design work in an industrial plant in the Montreal area with experience in building construction, probably permanent position salary from $200 up according to experience. Apply File No. 3504-V.

CIVIL ENGINEERS with experience in detailing and designing structural steel and reinforced concrete for manufacturers are required for a steel fabricating company in Manitoba. Salary open. Apply File No. 3519-V.

CIVIL ENGINEERS, recent graduate up, required by a pulp and paper company with plants in Eastern Canada. Salary open. Apply to File No. 3549-V.

CIVIL ENGINEER, age 35-40, with extensive experience in detailing and checking structural steel in buildings and bridges, required by a steel fabricating company in Southern Ontario. Salary open. Apply to File No. 3570-V.

CIVIL ENGINEER, senior designer, experienced in reinforced concrete and structural steel and general building construction, required to take charge of structuraldesign staff for a firm of consulting engineers in Montreal. Salary $300–$400. Apply to File No. 3585-V.

CIVIL ENGINEERS with master's degree, teaching and consulting experience, age 28-40, required for the staff of a university in N.Y. State. Salary open. Apply to File No. 3600-V (C).

CIVIL ENGINEER, preferably with railroad experience, required by a company engaged in large scale asbestos production in Quebec to supervise construction of local railroad. Salary open. Apply to File No. 3683-V.

CIVIL ENGINEER, recent graduate up, required for government organization on West Coast, to carry out field surveys, investigations of water resources and their application and to make reports, maps, plans, etc. Salary $200 up. Apply to File No. 3724-V.

CIVIL ENGINEER, with at least five years' experience, to be assistant to the Director of Community Planning of the Province of Saskatchewan. Starting salary $200-$250. Apply to File No. 3746-V.

CIVIL ENGINEER with experience in survey and construction, preferably bilingual, required to take charge of the engineering department for the woods operations of a paper company in Eastern Quebec. House available. Salary $350 up. Apply to File No. 3749-V.

CIVIL ENGINEER, qualified O.L.S., required as town engineer and superintendent of works for a town in Central Ontario. State age and salary desired. Apply to File No. 3750-V.

CIVIL ENGINEER with considerable experience in the design and construction of structural steel and reinforced concrete structures, required by a firm of consulting engineers in Toronto. Salary open. Apply to File No. 3753-V.

GRADUATE CIVIL ENGINEER, required by a public utility in the Montreal area with three or four years' experience in design of reinforced concrete and structural steel. Salary $250-$300. Apply to File No. 3766-V.

GRADUATE CIVIL ENGINEER, required as structural designing engineer by a firm engaged in the manufacture of cranes, crushers, pumps, etc., in the Toronto area. Preferably with 5 to 10 years' experience in designing and detailing steel buildings and bridges. Salary open. Apply to File No. 3771-V.

CIVIL ENGINEER is required to act as Town Engineer and take complete charge of the engineering service of a town in Ontario. Maximum salary $3,000. per annum. Apply to File No. 3782-V.

GRADUATE CIVIL ENGINEER required by an industrial corporation in Montreal for design work in draughting room. Must be familiar with structural steel and concrete design. Position offers good opportunity and permanency to right man. Salary from $250 up according to experience, Apply to File No. 3785-V.

ELECTRICAL

ELECTRICAL ENGINEER, age 32-36, with electrical experience around mines or smelters. English speaking with working knowledge of French, is required by a company in Shawinigan Falls, Quebec. Salary open. Apply to File No. 3415-V.

ELECTRICAL ENGINEER age 30 - 45 with sales training with large manufacturer of electrical equipment instruments and 5-10 years experience as sales service and sales engineer required as sales engineer in Canada for U.S. firm making special equipment for transport and industry. Salary open. Apply to File No. 3447-V.

ELECTRICAL ENGINEER, recent graduate, required for the engineering staff of a paper mill in the Lake St. John area. Salary open. Apply to File No. 3507-V.

ELECTRICAL ENGINEERS, from recent graduates up, required by a company in Montreal engaged in the production of telephone, etc., equipment Veterans preferred. Salary open. Apply to File No. 3551-V.

ELECTRICAL ENGINEER with knowledge of power apparatus, preferably bilingual, required for sales work with a manufacturer in the Montreal area. Salary open. Apply to File No. 3646-V.

ELECTRICAL ENGINEER with considerable industrial experience required as a safety engineer by a public utility in the Montreal area. Bilingual preferred. Salary open. Apply to File No. 3654-V.

ELECTRICAL ENGINEER to be chief engineer, responsible for electrical and mechanical design and testing, required by a firm in Ontario manufacturing electric motors. Salary open. Apply to File No. 3656-V.

ELECTRICAL ENGINEER with several years experience required as a designer by an industrial organization in Montreal. Salary open. Apply to File No. 3677-V.

ELECTRICAL ENGINEER, with general knowledge of a.c. and d.c. motors, switchgear, mercury rectifiers, transformers and other electrical apparatus, for sales work in Eastern Canada, age 30 to 35, salary open. Apply to File No. 3695-V.

ELECTRICAL DRAUGHTSMAN with several years' experience in industrial layouts for large concern in Eastern Townships. Permanent position and attractive salary available for experienced men. Apply to File No. 3701-V.

ELECTRICAL ENGINEER, age about 30, with considerable experience, required by a manufacturer in the St. Maurice Valley. Salary open. Apply to File No. 3723-V.

ELECTRICAL ENGINEER, with at least five years experience on overhead and underground transmission and distribution systems. Required as distribution engineer by a public utility in Brazil. Salary open. Apply to File No. 3738-V.

ELECTRICAL DESIGNING DRAUGHTSMAN with broad practical experience and theoretical knowledge required for a firm in Quebec. Salary from $225. Apply to File No. 3743-V.

ELECTRICAL DESIGNING DRAUGHTSMAN with considerable industrial experience and initiative required by an electrical firm in Montreal. Salary open. Apply to File No. 3751-V.

ELECTRICAL ENGINEER with estimating and contract experience, required as office engineer by an electrical firm in Montreal. Salary open. Apply to File No. 3751-V.

ELECTRICAL ENGINEER, recent graduate up, required by a manufacturer in Montreal, for sales engineering. Preferably bilingual and familiar with rotating electrical equipment. Salary $200. up. Apply to File No. 3761-V.

JUNIOR ELECTRICAL ENGINEER, required to act as assistant in an engineering sales office of an electrical firm in the Montreal area. Salary open. Apply to File No. 3768-V.

GRADUATE ELECTRICAL ENGINEER with 5 or more years experience in electrical equipment of buildings, required by a consulting engineer in Montreal. Salary open. Apply to File No. 3773-V.

GRADUATE ELECTRICAL ENGINEER with at least three years experience, preferably construction required by a manufacturer in Central Ontario, to supervise electrical installations on construction jobs. Salary open. Apply to File No. 3775-V.

GRADUATE ELECTRICAL ENGINEERS with 3 to 10 years experience in design, operation, layout of substations, switching stations, and electrical machinery, together with engineering studies, including draughting for a large hydro electric power house in Quebec. Salary $225 up. Apply to File No. 3787-V.

GRADUATE ELECTRICAL ENGINEER, required to train as Sales Engineer with National organization. Permanent position. Must be prepared to be stationed in Alberta or Saskatchewan. Reply giving full particulars. Enclose photo when answering. Apply to File No. 3790-V.

MECHANICAL

MECHANICAL ENGINEER, is required for draughting and detail work with a company in central Ontario. Good prospects for advancement. Single man preferred. Salary open. Apply to File No. 3393-V.

MECHANICAL ENGINEERS, preferably with design experience, are required for armament research and development in the Quebec area, in a government establishment. Salary from $190. Apply to File No. 3401-V.

MECHANICAL ENGINEER with experience in pulp and paper or mining work required by a pulp and paper company with plants in Eastern Canada. Salary open. Apply to File No. 3549-V.

MECHANICAL ENGINEER from recent graduates up, preferably with paper and pulp experience, required by a firm in the St. Maurice Valley. Salary according to experience. Apply to File No. 3573-V.

MECHANICAL ENGINEERS to be design squad leaders on heavy machinery design required by a company in Central Ontario. Salary open. Apply to File No. 3623-V.

MECHANICAL ENGINEER recent graduate, required by an industrial firm in south western Quebec, for the design and erection of complex textile machinery. Salary open. Permanent position. Apply to File No. 3625-V.

UNIOR MECHANICAL ENGINEER with construction or machine shop experience, required by a Montreal firm handling heavy construction equipment. Salary open. Apply to File No. 3635-V.

MECHANICAL ENGINEER with experience in the fabrication of Farm Implements, required by a Quebec firm. Bilingual man preferred. Salary according to experience. Apply to File No. 3666-V.

MECHANICAL ENGINEER with experience in the design of industrial machinery required by a Montreal firm manufacturing custom built machines. Salary $200-$250. Apply to File No. 3669-V.

MECHANICAL ENGINEER with design experience in the pulp and paper industry required by a firm with headquarters in Montreal. Salary $350. Apply to File No. 3673-V.

JUNIOR MECHANICAL ENGINEER with knowledge of precision machine shop practice and aptitude for research work in metals and plastics required for an organization in Toronto for the production of artificial limbs. Must be veteran. Salary from $225. Apply to File No. 3675-V.

MECHANICAL ENGINEER with industrial or construction experience, required by a firm of consulting engineers to inspect machinery deliveries in the Cornwall area. Salary open. Apply to File No. 3691-V.

MECHANICAL ENGINEER, recent graduate up, required for maintenance and production engineering by an industrial firm in Montreal. Salary open. Apply to File No. 3692-V.

MECHANICAL ENGINEERS, age 25-35, required by a manufacturer in Montreal, for training as sales engineers and for executive positions. Salary from $200. Apply to File No. 3710-V.

JUNIOR MECHANICAL ENGINEER, under 30 and preferably bilingual, required by a Montreal firm to train as sales engineer for pumps, engines and allied electrical equipment. Salary open. Apply to File No. 3714-V.

MECHANICAL ENGINEER, under 45, with at least ten years' experience in design of heating, ventilating and refrigeration layouts, required as heating engineer for a government organization on West Coast. Salary $250-300. Apply to File No. 3724-V.

YOUNG MECHANICAL ENGINEERS, with practical experience either in automotive or general manufacturing industries, together with ability to operate engineering office systems, required by an industrial organization in Ontario. Salary open. Apply to File No. 3732-V.

MECHANICAL ENGINEERS, with at least five years' experience in the Pulp and Paper industry required by an Ontario Paper Company. Salary open. Apply to File No. 3733-V.

SENIOR MECHANICAL ENGINEER, ten to fifteen years' experience required by a West Coast manufacturer of heavy equipment and vehicles to take charge of engineering design and inspection departments. Salary about $350. Apply to File No. 3734-V.

MECHANICAL ENGINEERS, with experience in plant layouts and design or ventilation problems or general mechanical design, required by a firm in Quebec. Salary from $250. Apply to File No. 3743-V.

MECHANICAL DESIGN DRAUGHTSMAN with experience in reinforced concrete and structural steel required by a mining company in Northern Ontario. Housing available. Salary open. Apply to File No. 3756-V.

JUNIOR MECHANICAL ENGINEER with industrial experience required as assistant to the plant engineer in a factory in the Montreal area. Salary about $225. Apply to File No. 3758-V.

GRADUATE MECHANICAL ENGINEER, experienced in boiler operation, required as assistant superintendent on maintenance of railroad and tramways rolling stock, in the Quebec area. Salary $200. per month. Apply to File No. 3772-V.

MECHANICAL ENGINEER with 5 or more years experience in heating, ventilating and air-conditioning, required by a consulting engineer in Montreal. Salary open. Apply to File No. 3773-V.

JUNIOR MECHANICAL ENGINEER, required by a manufacturer in Central Ontario, to be responsible to Mechanical Superintendent. Salary open. Apply to File No. 3774-V.

MECHANICAL ENGINEER, with paper mill or mining experience required for design and layout by a paper mill in Northern Quebec. Salary $375-400. Apply to File No. 3778-V.

MECHANICAL ENGINEER with considerable experience willing to act as assistant to Mechanical Superintendent of a textile manufacturing concern near Montreal. Salary open. Apply to File No. 3784.-V

SENIOR MECHANICAL DRAUGHTSMAN, age 25 to 45, with at least 5 years mechanical design and detailing experience, required for the mechanical department of an industrial organization in Montreal. Salary from $230 up according to experience. Apply to File No. 3786-V.

MECHANICAL ENGINEER, recent graduate up, required by a Pulp and Paper Company in the Province of Quebec for work entirely centred in logging operations. Salary open. Apply to File No. 3789-V.

MECHANICAL ENGINEER, recent graduate up, required by major oil company in Montreal area. Salary $175 up according to experience. Apply to File No. 3792-V.

MINING

MINING ENGINEER with several years experience required by a company engaged in large scale asbestos production in Quebec. Salary open. Apply to File No. 3683-V.

MINING ENGINEERS, with varied experience required by a firm in Quebec for general mine operation, exploitation and development work. Salary from $250. Apply to File No. 3743-V.

MISCELLANEOUS

MANAGEMENT ENGINEER with business administration and mechanical background, age 30 up, bilingual with at least 5 years practical experience, required by an industrial engineering consultant in Montreal. Apply to File No. 3307-V.

CIVIL OR MECHANICAL ENGINEER with experience in pulp and paper mills, to be assistant to plant engineer in a paper mill in Central Quebec. Salary open. Apply to File No. 3445-V.

TWO STRUCTURAL STEEL DRAUGHTSMEN with five or more years experience in designing and detailing steel structures. State experience and salary required. Location Toronto. Apply to File No. 3451-V.

STRUCTURAL STEEL DRAUGHTSMEN AND CHECKERS, preferably graduate engineers but any experienced men acceptable, are required for a steel fabricating company in Manitoba. Salary open. Apply to File No. 3519-V.

ASSISTANT PLANT ENGINEER with paper mill experience required by a pulp and paper company with plants in Eastern Canada. Salary open. Apply to File No. 3549-V.

GRADUATE ENGINEERS with experience in air-conditioning, heating, refrigeration and allied problems, required by a manufacturer in the Montreal area. Salary open. Apply to File No. 3566-V.

DESIGN ENGINEER with considerable experience required by a pulp and paper firm in the St. Maurice Valley. Salary open. Apply to File No. 3573-V.

GRADUATE ENGINEERS, required by a large industrial and chemical organization with headquarters in Montreal for all phases of research design, operation, development, production and maintenance. Salaries open. Apply to File No. 3588-V.

ASSISTANT PROFESSORS AND INSTRUCTORS required for the staff of a technical college in New York State. Salary open. Apply to File No. 3600-V. (A)

DESIGN ENGINEERS with experience in reinforced concrete and hydraulic structures for hydro-electric developments for an engineering firm with headquarters in Toronto. Salary open. Apply to File No. 3612-V.

CHIEF ENGINEER with industrial experience required for a steel fabricating plant in Western Canada. Salary open. Apply to File No. 3616-V.

STRUCTURAL AND MECHANICAL DRAUGHTSMAN required for detail drawings by a steel fabricating plant in Western Canada. Salary open. Apply to File No. 3616-V.

DESIGN DRAUGHTSMAN for the design of cranes and hoists of all types, capable of making and checking complete manufacturing detail drawing, required by a manufacturer in Southern Ontario. Apply to File No. 3628-V by letter with full details. Salary open.

SALES ENGINEER with wide engineering experience wanted by a company in Toronto for the sale of textile machinery and construction equipment. Salary open. Apply to File No. 3639-V.

MECHANICAL AND STRUCTURAL DESIGNERS AND DRAUGHTSMEN required by a pulp and paper company in the Port Arthur district. Salary open. Apply to File No. 3653-V.

ASSISTANT ENGINEER with experience in estimates and specifications for industrial work required by a pulp and paper company in the Port Arthur district. Salary open. Apply to File No. 3653-V.

CHIEF DRAUGHTSMAN with at least five years draughting room and related engineering office experience, preferably in pulp and paper or process industries, required by a pulp and paper mill in the Port Arthur district. Salary open. Apply to File No. 3653-V.

CIVIL OR MECHANICAL ENGINEER, required by a pulp and paper company in Newfoundland to look after new development work and general engineering in connection with woods operations. Salary open. Apply to File No. 3655-V.

ASSISTANT PLANT ENGINEER, preferably with pulp and paper or structural design experience, required for a newsprint mill in a city on north shore of Lake Superior. Salary open. Apply to File No. 3657-V.

MECHANICAL OR ELECTRICAL ENGINEERS for training as production engineers with an industrial firm in Montreal. Salary open. Apply to File No. 3662-V.

JUNIOR ENGINEERS preferably with pulp and paper or other industrial experience required for training for the sales staff of a Montreal manufacturer of machines and equipment. Salary from $175. Apply to File No. 3664-V.

GRADUATE ENGINEERS for mechanical design, experimental, test and development departments of a Canadian firm producing aircraft gas turbines. Salary open. Apply to File No. 3667-V.

STRUCTURAL DESIGNERS AND DRAUGHTSMEN required by a firm of consulting engineers in Montreal. Salary open. Apply to File No. 3668-V.

JUNIOR ENGINEERS, recent graduates up, as designing draughtsmen for a brewing company with headquarters in Montreal. Salary from $200. Apply to File No. 3670-V.

SALES ENGINEER with knowledge of sawmill and woodworking equipment, preferably bilingual, required for the sale of specialized equipment. Salary $200 plus commission. Apply to File No. 3678-V.

JUNIOR ENGINEER, recent graduate up, required as surveyor by a company engaged in large scale asbestos production in Quebec. Salary open. Apply to File No. 3683-V.

CIVIL OR MECHANICAL ENGINEERS with design or structural experience required by a manufacturer of contractors' equipment in the Hamilton area. Salary open. Apply to File No. 3698-V.

CONSTRUCTION ENGINEER with field experience, age about 30, required as office engineer and assistant to general manager for a firm of contractors in Montreal. Salary open. Apply to File No. 3703-V.

SPECTROSCOPIST with experience in chemical analytical work and the use of the commission spectograph required by an industrial organization with headquarters in Montreal. Salary open. Apply to File No. 3706-V.

FORESTRY ENGINEER, recent graduate up, required by a paper company for woods operations on the Lower St. Lawrence. Salary from $175. Apply to File No. 3707-V.

JUNIOR ENGINEERS, recent graduate up, required for the engineering staff of a communications company with headquarters in Montreal. Veterans preferred. Salary from $175. Apply to File No. 3713-V.

JUNIOR STRUCTURAL DESIGN ENGINEER required by a steel fabricating firm in Central Ontario. Salary open. Apply to File No. 3715-V.

JUNIOR ENGINEERS, preferably with some mechanical design experience, required for the engineering staff of a manufacturer in Sherbrooke. Salary open. Apply to File No. 3721-V.

JUNIOR ENGINEERS, recent graduates up, with mechanical background required by a Montreal manufacturer for the design and supervision of boiler plant installations, preferably bilingual. May have sales work. Salary from $200. Apply to File No. 3722-V.

MINING AND METALLURGICAL ENGINEER, age about 30, with considerable experience, required by a manufacturer in the St. Maurice Valley. Salary open. Apply to File No. 3723-V.

CONSTRUCTION ENGINEER with considerable experience required for the permanent staff of a Montreal inspection company. Salary about $200. Age immaterial. Apply to File No. 3728-V

JUNIOR ENGINEER, preferably with experience in heating and combustion problems, required by a specialist firm in Montreal. Salary $250-325. Apply to File No. 3729-V.

SALES ENGINEERS, with mechanical and electrical background, bilingual, required by a Montreal firm handling road building and contractors equipment, generators, pumps, etc. Salary open. Apply to File No. 3737-V.

DETAILER AND DESIGNER for reinforcing steel with considerable experience required by a steel fabricating firm in Montreal. Salary open. Apply to File No. 3740-V.

STRUCTURAL STEEL DETAILER AND CHECKER with considerable experience required for checking shop details by a steel fabricating firm in Montreal. Salary open. Apply to File No. 3740-V.

DESIGN ENGINEERS, age about 30, with experience in the design and layout of chemical plants, required by an industrial organization in the St. Maurice Valley. Salary from $250. Apply to File No. 3741-V.

DESIGN DRAUGHTSMEN, age about 25, with experience in chemical plant layouts, required by an industrial organization in the St. Maurice Valley. Salary from $200. Apply to File No. 3741-V.

INDUSTRIAL ENGINEER, with broad experience in plant development, operation, costs and management required for a firm in Quebec. Salary from $250. Apply to File No. 3743-V.

SALES ENGINEER required in the St. John, N.B., district by a firm handling oil purifiers, piston rings and allied engineering products. Salary $250. plus commission. Apply to File No. 3744-V.

SALES ENGINEER, preferably bilingual, required by a Montreal firm dealing in building materials. Salary from $200. Apply to File No. 3745-V.

GRADUATE ENGINEERS, recent graduates up, preferably mechanical, required for the engineering and operating staff of a pulp mill in Eastern Quebec. Salary open. Apply to File No. 3748-V.

PUBLICITY ENGINEER required by an electrical firm in Montreal to organize publicity department and edit trade journal. Salary open. Apply to File No. 3751-V.

GRADUATE ENGINEER, under 40, with industrial and manufacturing experience and some knowledge of sales, required by a bolt and nut manufacturer in the Montreal area. Salary open. Apply to File No. 3752-V.

GRADUATE ENGINEER required by an insurance company in Montreal for the inspection of boilers, steam plant and allied equipment. Salary from $200. Apply to File No. 3754-V.

TECHNICAL GRADUATE, preferably Mechanical, Chemical or Electrical, under 30, veteran preferred, for permanent position with engineering organization. Training period in U.S. Work will include travelling for consultation among leading industrial plants. Enclose photo when answering. Salary open. Apply to File No. 3759-V.

CHIEF DRAUGHTSMAN with experience in Pulp and Paper Mill design wanted immediately in Port Arthur. Reply stating education, experience. Salary open. Apply to File No. 3760-V.

CIVIL, MECHANICAL OR CHEMICAL ENGINEERS, recent graduates up, preferably with experience in petroleum and heavy industry such as chemical or paper, required by an oil company in Toronto. Salary open. Apply to File No. 3762-V.

GRADUATE ENGINEER, with practical experience, production and maintenance, to take charge of Farm Equipment Factory with Grey Iron Foundry, located in Ontario. Apply with photo or snapshot to File No. 3764-V. Salary open.

GRADUATE ELECTRICAL OR MECHANICAL ENGINEER, must have thorough knowledge of fractional H.P. Motors required by a Montreal firm to take charge of small engineering department. Salary $350-$500. Apply to File No. 3770-V.

ROD-MEN AND INSPECTORS up to ASSISTANT PROJECT ENGINEERS, wanted by an American Engineering firm for an employment contract in Alaska for one year. Board and room furnished also transportation from point of hire. Excellent salary. Apply to File No. 3776-V.

STRUCTURAL STEEL DRAUGHTSMAN, qualified to detail and check all classes of structural steel and to supervise draughtsmen in a large drawing office on the West Coast. Salary open. Apply to File No. 3777-V.

DESIGN ENGINEER to make investigations and preliminary drawings of cost estimates of alterations to buildings and machinery for a large paper mill in the St. Maurice Valley. Salary around $300. Apply to File No. 3779-V.

MECHANICAL OR ELECTRICAL ENGINEER, age 25-35, required as field service engineer, to handle technical refrigeration service and maintain liaison with national distributors, dealers and service organizations, in the Provinces of Canada, for an American firm. Salary $300-350. Enclose photo when answering. Apply to File No. 3781-V.

GRADUATE CIVIL OR MECHANICAL ENGINEERS with 3 to 10 years experience in design, cost estimates, draughting, and engineering studies for a large hydro-electric power house in Quebec. Salary $225 up. Apply to File No. 3787-V.

SALES ENGINEER with electrical engineering background in public utility or industrial field required by wire and cable manufacturer for engineering contact work in Ontario. Salary open. Apply to File No. 3788-V giving complete details.

GRADUATE ENGINEER with experience in pre-stressed concrete and pipe manufacture, required by construction firm in Montreal area, veteran with administrative experience preferably. Salary open. Apply to File No. 3793-V.

GRADUATE, with some knowledge of looms, weave construction and cloth analysis, required as manager for rayon weaving plant in Peru. Administrative ability necessary. Knowledge of Spanish would be an advantage although not a necessity. Salary open. Apply to File No. 3794-V.

University of Manitoba Requires Engineering Instructors

The Faculty of Engineering and Architecture of the University of Manitoba will require additional instructors for teaching duties beginning with the session 1947-1948. Applicants should be Engineering graduates from recognized Universities. The grades required will be assistant professors, lecturers and demonstrators in Civil Engineering and Mechanical Engineering. Salaries will depend on experience and general qualifications.

Apply as soon as possible to Dean of Engineering and Architecture, University of Manitoba, Winnipeg.

University of Toronto Requires Engineer Instructors

Instructors of various grades up to and including lecturer are required by the Faculty of Applied Science and Engineering of the University of Toronto for duty starting in September, 1947. Applicants must be engineering, science, or mathematics graduates. Salary will depend on experience and general qualifications.

Apply to the Secretary of the Faculty of Applied Science and Engineering, Mining Building, University of Toronto.

SUMMER EMPLOYMENT...WANTED

The Employment Service of the Engineering Institute is endeavouring to aid their Student members to obtain suitable practical experience during the summer months. We would appreciate any assistance from firms anticipating such openings.

Situations Wanted

CIVIL ENGINEER, Jr. E.I.C., P.Eng., McGill, 30 years of age, bilingual, ex-R.C.E. officer, 3 years' experience on construction, 2 years pulp and paper industry, 1 year with public utility firm, administrative and contact ability, seeking permanent position. Available on short notice. Apply to File No. 1552-W.

YOUNG CIVIL ENGINEER, M.E.I.C., would accept some work at night at home. Preparation of estimates and tenders. At present employed on construction work. Apply to File No. 2128-W.

GRADUATE ENGINEER, M.E.I.C., member of Board of Trade, Corporation of Professional Engineers, age 33. Interested in: Consultation, analyzing problems, constructive planning, programming projects and over-all direction. Have had real experience and responsibilities in executive planning, inspection and supervision in industry, scheduling, control, costing, promoting production, customer satisfaction, technical sales. Apply to File No. 2441-W.

CIVIL ENGINEER, B.A.Sc., M.E.I.C., P. Eng., .ex-R.C.E. Officer with several years experience in municipal, highway and hydraulic engineering. Presently employed but interested in position with municipality or firm where extensive construction and maintenance work is contemplated. Apply to File No. 2463-W.

HYDRAULIC ENGINEER, B.Sc., M.E.I.C., 20 years experience in Hydraulics relative to hydro-electric power development, hydraulic machinery design and manufacture and development in hydraulic turbine design. Experience in handling men. Desires change in position. Apply to File No. 2638-W.

CIVIL ENGINEER, M.E.I.C., Registered Professional Civil Engineer of Ontario, Resident Engineer on large unit price projects plus wide general experience. Available on short notice. Apply to File No. 2651-W.

ELECTRICAL-MECHANICAL ENGINEER, Jr.E.I.C., age 30, graduate of Naval Electrical Engineering Officers course at Nova Scotia Technical College, 1945. Graduate of Naval Electrical Artificer's course at University of Alberta, followed by 6 months of instructional work on same. One year at sea as Chief Electrical Artificer on frigate, in charge of all electrical equipment. Completed apprenticeship as machinest in railway repair shops in design work testing, research and calculations. Available on two weeks notice. Apply to File No. 2693-W.

MECHANICAL ENGINEER, S.E.I.C., P.E.Q., Jun. A.S.M.E., McGill 1946. Age 22. Single. Experience in methods engineering, tool design, heating and ventilating. Would prefer position with an established firm with a machine shop in order to gain shop experience. Suitable position anywhere in Canada acceptable. Available on short notice. Apply to File No. 2707-W.

CIVIL ENGINEER, B.A., B.Sc., M.E.I.C., R.P.E., age 44, with over 20 years' experience in railway, municipal and highway engineering, also consultative, including design, location, construction and maintenance. Extensive administrative and executive experience. Desires position in construction engineering or superintendent for construction firm. Apply to File No. 2808-W.

ELECTRICAL ENGINEER, Jr. E.I.C., age 34, R.P.E., Ont., on University staff, with sales, maintenance and switchboard design experience. Desires summer employment. Apply to File No. 2809-W.

GRADUATE ENGINEER, mining, Jr. E.I.C., R.P.E., Ont., age 31, married. Approximately three years' experience in mine and land surveying, and three years as a supervisor in production, development and process control in heavy industry. Presently employed, but interested in a position with Consulting Engineer, Surveyor, or in Production. Location preference: Ottawa or Toronto areas. Apply to File No. 2810-W.

RECENT GRADUATE ENGINEER—(Civil, electrical, mechanical) B.Sc., S.E.I.C., would accept sales work during spare time, anywhere in Province of Quebec. Apply to File No. 2814-W.

YOUNG MECHANICAL ENGINEER, B.A.Sc. Toronto, S.E.I.C., single, now engaged in product design and development with firm in the Maritimes, would prefer similar work in Southern Ontario requiring more technical and also some artistic ability. Apply to File No. 2818-W.

GRADUATE CIVIL ENGINEER, M.E.I.C., P.E.Q., with five years intensive work with large pulp mill, construction, maintenance, estimate, layouts, process development, time study, etc., also experience in public workmanagement: water, sewer, electric system generation, transmission and distribution with full responsabilities of design and work, etc. Services available at short notice. Age 30, married and bilingual. Apply to File No. 2823-W.

GRADUATE MECHANICAL ENGINEER, Toronto '37, M.E.I.C., P.E.Q., with 10 years experience in design, layout and production of power plant and allied equipment. Available on short notice. Montreal area preferred. Apply to File No. 2826-W.

ELECTRICAL ENGINEER, M.E.I.C., graduated '34, desires summer employment (May 20th-Sept. 15th). At present teaching in Electrical Engineering Department of a University in Eastern Canada. Experience: 4 years' Power and Telegraph Line Construction, 3 years Assistant Electrical Superintendent in a Canadian Gold Mine, 3 years' R.C.E. Electrical Distribution Layouts. Apply to File No. 2827-W.

MECHANICAL ENGINEER (Sask. '45), S.E.I.C., one year's experience with Consultant Engineering Firm, desires employment in Plant maintenance or design, preferably in the vicinity of Toronto, Montreal or Winnipeg. Available June 1st. Apply to File No. 2829-W.

GRADUATE ENGINEER, age 39, bilingual, M.E.I.C., P.E.Q., Ex-R.C.E., with extensive experience on staff work involving planning, organization, administration, procedure and secretarial duties. Varied experience in civil, and electrical engineering including planning, coordination and execution of large projects. Would be interested in position as executive or assistant either in engineering or business organization. Apply to File No. 2832-W.

METALLURGICAL ENGINEER, expert in research, design and management phases of non-metallic mineral industry. Age 41. Experience includes 10 years as manager. Desires connection in similar capacity with reliable concern. Available April 30th. Apply to File No. 2831-W.

PRELIMINARY NOTICE

(*Continued from page 194*)

instru'man., layout work, on constrn. projects, H.E.P.C. of Ontario; with Geo. Wimpey & Co., Ltd., London, Eng. (bldg. and civil engrg. contractors), 1938, (1 mo.), engr. on concrete, Great Western Rly. (Greenford Viaduct), 1939-40, engr. on external services and layout, balloon barrage depots, Air Ministry, Lancashire, 1940, engr., i/c concrete sewers, aerodromes in Middlesex, Hampshire, Caithness, 1940-42, asst. supt., i/c excavation, concrete, sewers on 4 R.A.F. Stations in Eng. 1942-45, supt., aerodrome constrn., aerodrome landing ground, tarmac runways, etc., completion of 2 mi. rly sidings on Great Western Rly., contract for advanced preparation of site for 500 houses at Farnborough; 1945 to date, asst. supt., Anglin-Norcross, Ontario, Limited, on constrn. Mental Hospital, Ontario Dept. Public Works, Smiths Falls, Ontario.

References: P. N. Gross, R. W. Johnstone, R. L. Hearn, G. Mitchell, T. A. Barnett.

MARSHALL—EDGAR ALBERT, Major, M.B.E., of Kingston, Ont. Born at Halifax, N.S., Jan. 10, 1914. Educ.: B.Sc., (Civil Engrg.), Manitoba, 1936; 1936-37, mining engr., Western Dominion Coal Mines Ltd., Bienfait, Sask.; with Royal Canadian Ordnance Corps, as follows: 1937-39, Officer I/C Prod., L.M.G. and M.G.O., N.D.H.Q., rank of Lieut., 1940, Deputy Asst. Dir. Ordnance Services, 1st Cdn. Divn., Major, 1941-43, O/C Cdn. Ordnance Field Parks, Tech. Stores, Lieut. Col., 1943-44, O/C 2nd Cdn. Corps, 1944-45, O/C 1st Cdn. Army Ammunition Coy., 1946, Chief Inspecting Ord. Officer, Cdn. Army, Canada, H.Q., Ottawa, I/C Army Amm. and Explosives Inspection, with rank of Major; and at present, Canadian Staff College, Kingston, Ont.

References: E. P. Fetherstonhaugh, S. Slater, W. S. Hunt, D. H. Rochester, W. F. Riddell.

ORD—LEWIS REDMAN, of 54 Regal Road, Toronto, Ont. Born at Weymouth, Eng., Jan. 18, 1910. Educ.: B.A.Sc., Toronto, 1933; R.P.E. Quebec; 1933, (3 mos.), jr. dftsman., Christian & Nielsen, Ltd., London, Eng.; 1934, (4 mos.), jr. dftsman., Trussed Concrete Steel Co., London, Eng.; 1934-35, ind. engr., London, Midland & Scottish Rly.; 1935-36, dftsman., Humphries & Glasgow Ltd., London, Eng.; 1936-38, time study engr., Joseph Lucas Ltd., Birmingham, Eng.; 1938, (6 mos.), asst. chief time study engr., Plessey Co., Ltd. Ilford, Eng.; 1938-39, Prod. Engr. Officer, British Air Ministry, London, Eng.; 1939-42, prod. engr., Canadian Assoc. Aircraft, Ltd. Montreal, Que.; 1942, prod. engr., Rogers Majestic Ltd., Toronto, Ont.; 1942-43, sr. ind. engr., Stevenson & Kellogg Ltd., Toronto and Montreal; Dowty Equipment Ltd., Cheltenham, Eng., 1944-45, asst. to genl. mgr., 1945-46, mgr., ind. direction; at present, sr. ind. engr., Stevenson & Kellogg, Ltd. Montreal, Que.

References: P. F. Sise, J. E. Dion, D. Boyd, T. M. Moran.

PARR—JOHN VERNON, of 389 Rankin Blvd., Windsor, Ont. Born at Windsor, Ont., Sept. 4, 1921. Educ.: B.A.Sc., (Elect. Engrg.), Toronto 1943; R.P.E., Ontario; 1940-42, (summer), Ford Motor Co. of Canada; 1943-45, Royal Canadian Navy; 1946 to date, jr. project engr., Canadian Industries Ltd. Windsor, Ont.

References: H. Lillie, W. J. Fletcher, F. A. Ritchie, J. W. Greason, H. L. Johnston.

PATTON—GEORGE LLOYD, of Pointe du Bois, Man. Born at Edmonton, Alta., Dec. 2, 1916. Educ.: B.Sc., (Elect. Engrg.), Manitoba, 1939; 1942-45, R.C.E.M.E., Lieut, 1st Cdn. Armoured Brigade, then Capt. 59th L.A.D., 1st Cdn. Armoured Brigade, O/C 59 L.A.D. att. 11th C.A.R.; 1946 to date, jr. engr., power plant, City of Winnipeg, Hydro Electric System, Winnipeg, Man

References: H. L. Briggs, T. E. Storey, R. A. Stewart, W. F. Riddell, E. P. Fetherstonhaugh.

THE ENGINEERING JOURNAL

THE JOURNAL OF THE ENGINEERING INSTITUTE OF CANADA

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COVER PICTURE

One of the main problems in handling coal in a large metropolis is the unloading of the bulk commodity from the holds of boats to storage piles, and the subsequent handling for screening before distribution by motor-truck.

The cover illustration shows a coal-bridge in the yards of the Rochester Pittsburgh Coal Company Canada Limited, Wellington Basin, Montreal, capable of handling on straight digging, 225 tons of coal per hour from the holds of lake boats.

(Fabricated by Dominion Bridge Company)

President's Message

For sixty years the Institute has served the profession of engineering in Canada, and we may look back with some satisfaction on what has been accomplished since 1887. The service we can render to society, our standing with the public and our fellowship within the profession have all increased, and the material rewards to the individual engineer are far better than they were at the time of the birth of the Canadian Society of Civil Engineers.

Particularly the status of the young man entering the profession is greatly improved. Sixty years ago he found it difficult to get a good engineering education in Canada; to-day in every part of the country there are engineering schools which can challenge comparison with any elsewhere. In 1887 the young graduate was a nobody, but in 1947 many of our corporations look upon him as the material from which future leaders will be made, and train him accordingly.

In both wars, members of the Institute have served on the battlefield and in production with honour to themselves and benefit to Canada.

On the other hand we must admit that Canadian engineering is too much inclined to copy and not ready enough to originate, and that there are few structures and few trends in engineering which we can claim as peculiarly Canadian. We have been content to remain competent imitators and improvers, rather than audacious pioneers.

Frequently too, we have thought more of efficiency and economic excellence than we have of aesthetics, and some of our work has left scars on the natural beauty of our country. There are many honourable exceptions, but as a whole, Canadian engineering has been too ready to sacrifice beauty and grace to stark utilitarianism. Nor have we played that part in conserving the natural resources of Canada that our knowledge qualified us to do.

As the achievements of the next sixty years will surpass those of the last, in magnitude and in usefulness to mankind, so we may hope that good engineering and satisfying appearance will be inseparable, and that Canadian engineering may evolve its own characteristics.

In acknowledging the high honour that the Institute has conferred upon me, I pledge myself to serve it in the fullest measure possible.

Message du président

Au terme des soixante ans pendant lesquels l'Institut a servi la profession d'ingénieur au Canada, c'est avec satisfaction que nous pouvons jeter un regard en arrière et contempler ce qui a été accompli depuis 1887. Nous avons enregistré de grands progrès dans l'étendue de notre contribution au bien commun, dans notre position sociale et dans le développement de l'esprit de camaraderie au sein de la profession. De la même façon, la rémunération de l'ingénieur est beaucoup meilleure qu'elle ne l'était au moment de la fondation de la Société Canadienne des Ingénieurs Civils.

En particulier, la position du jeune ingénieur au seuil de la profession s'est beaucoup améliorée. Il y a soixante ans, il était difficile pour lui d'acquérir au Canada une solide formation d'ingénieur; il existe aujourd'hui, par tout le pays, des écoles d'ingénieurs qui peuvent rivaliser avec celles des autres pays. En 1887, le jeune diplômé était quantité négligeable, mais en 1947, plusieurs de nos compagnies le considèrent comme de l'étoffe dont on fait les chefs, et le préparent en conséquence.

Dans les deux guerres, les membres de l'Institut se sont distingués et ont servi le Canada tant sur les champs de bataille que dans la production industrielle.

D'autre part, il faut admettre que l'art de l'ingénieur au Canada tend vers la copie plutôt que vers l'originalité, et qu'il existe peu de structures et de tendances qui soient typiquement canadiennes. Nous nous sommes contentés d'imiter fidèlement et de perfectionner, plutôt que de faire œuvre de pionniers.

Trop souvent aussi, nos préoccupations de rendement et d'économie sans égard pour l'esthétique, ont laissé des marques honteuses sur la beauté naturelle de notre pays. Il existe plusieurs nobles exceptions, mais, en somme, l'art canadien de l'ingénieur a cédé trop facilement à l'utilitarisme froid, au grand détriment de la beauté et de la grâce. Non plus, hélas! n'avons-nous joué, dans la préservation de nos ressources naturelles, le rôle que nous imposait notre savoir.

Comme les réalisations des prochaines soixante années surpasseront, en magnitude et en profit pour l'humanité, celles du passé, ainsi pouvons-nous espérer que des formes plaisantes naîtront de conceptions saines, et que l'ingénieur canadien découvrira un art qui lui soit propre.

En acceptant l'honneur qui m'est conféré, je m'engage à donner le meilleur de moi-même au service de l'Institut.

L. F. Grant.

President.

THE DIRECT OPERATING COSTS OF TRANSPORT AIRCRAFT

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A paper delivered before the Montreal Branch of The Engineering Institute of Canada on April 17th, 1947.

In this paper, consideration is given to those items of airline costs which depend directly on the flying operations and which are affected by such things as aircraft size, power, initial cost, etc. These costs are known as the "direct operating costs". Comparatively simple equations are developed, based on the information given in aircraft manufacturers' brochures, which allow an estimate to be made of the various items which constitute the direct operating costs of any particular aircraft in Canada.

Examples are given of the application of the equations to specific cases. The paper concludes with a study of the effect of aircraft size, block distance, utilization and cruising speed on the economics of air transport operations.

In the air transport industry, revenues exceed the operating expenses by so small a margin, if at all, that a constant close scrutiny of expenses is imperative. References 1 to 10 indicate that this need has been recognized throughout the period during which the air transport industry was in its infancy. Mentzer and Nourse(11) carried out the first systematic study of air transport operating costs to receive general acceptance. They divided the total operating costs into three general groups: first, the direct or significant operating costs, defined as those resulting from the flight of an aeroplane or those affected by variation of aeroplane size, power, initial cost and aerodynamic efficiency; second, the passenger service costs, defined as those which vary with the number of passengers on board; third, the overhead costs. Mentzer and Nourse derived a series of formulae or equations from which the direct operating costs could be calculated in any particular case. These formulae have been widely used in the air transport industry. They have formed the basis for the development of alternative formulae considered more suitable in specific instances. In particular, the Mentzer and Nourse equations are the basis for the direct flying cost data given by the American Air Transport Association in its "Method of Presentation of Data for Proposed Aircraft".

In Canada it is customary to include passenger supplies, meals and interrupted trip expenses in the direct operating cost group.

This paper deals only with direct operating costs. The so-called indirect costs which include administration, ground operation, maintenance and depreciation of ground equipment and buildings, traffic and general administration, general taxes, etc., are beyond the scope of this study.

The original equations for calculating the several components of direct operating costs, as developed by Mentzer and Nourse, contain such symbols as the following:

C_a : Cost of aeroplane less engines
C_e : Cost of one engine
W_a : Weight of aeroplane less engines
W_e : Weight of one engine

Formulae developed by others on the basis of the Mentzer and Nourse method contain the same or similar symbols. In making an analysis of its operating costs an airline will, in general, be in a position to supply the required numerical values of such symbols. There are, however, a number of organizations interested in the question of direct air transport operating costs which do not have access to reliable information on the values of such symbols. It is the object of this paper to indicate the development of simplified formulae for the calculation of the direct operating costs of aircraft used in air transport work and to study some of the results obtained from the application of these formulae.

The commonest sources of information concerning new transport aircraft are the manufacturers' brochures describing the aircraft and the various press releases, usually containing the same or similar information. The brochures usually give the main dimensions, power, payload, cruising speeds, range, etc. It is often desired to make some comparative estimates of direct operating costs on new and existing aircraft, when the only information available is that contained in a manufacturer's brochure. In this paper an attempt is made to simplify the equations for direct operating cost to the extent that the symbols appearing in the equation are limited to those normally obtainable from the manufacturer's brochure. The equations themselves are in most cases based on the Mentzer and Nourse equations or on equations derived by similar methods. To some extent the experience of Trans-Canada Air Lines has been drawn from, as being representative of Canadian conditions, particularly in regard to labour and material costs per hour flown.

It is not considered that the simplification of the formulae has resulted in any significant loss in accuracy. For some of the items which go to make up the direct operating costs of an aircraft, no formula can be universally applicable with precision. For example, the aircraft and engine maintenance costs are to some extent a function of the quality of the design of the structure and the servicing costs are again dependent on the ingenuity of the designer, factors which cannot be represented in a mathematical formula. Therefore, whilst a formula can be given to analyze fairly accurately the operating costs of existing aircraft, there is never any certainty that it can be applied with reliance to the case of a new aircraft type. This paper is intended for the use of those who wish to make quick and reasonably reliable estimates of operating costs, where great precision is not a prime requirement. The formulae are based on Canadian costs for domestic operations but can be applied elsewhere by suitable changes in the values of the various assumed quantities. Each item is given in terms of the cost per aeroplane-mile flown.

1. FLYING PERSONNEL SALARIES

The formula for the determination of flying personnel salary costs per mile is usually dependent on the wage rate structure and may include such details as the number of flying personnel employed in specific categories. While such formulae are highly satisfactory for use by airlines, they do not lend themselves to more general use. This is because the wage rate structures vary in different countries and, in Canada, the wage rate structure is different for each airline and for the smaller operators. In the case of pilots, for instance, there is a basic wage which varies among the airlines, with or without a commission based on miles flown or flying revenue. There is also, of course, a distinction between the pay of captains and first officers. In all cases there are pay increases for length of time with the company. There is a higher pay for flight over mountainous terrain than when over flat terrain, in the case of one company which operates over both types of terrain. In the case of stewardesses, there are pay increases with length of service and there may or may not be a distinction during the training and probationary periods.

For the purpose of this study, typical average salary classifications have been assumed for pilots and an average salary assumed for stewardesses, as shown in Table I. Depending on the aircraft gross weight, typical salary classifications have been assumed for the pilot or pilots, as shown in Table II. The agreements between the airline pilots and their companies usually include a limitation on the flying time permitted in any given period. On the average this allows pilots to fly a maximum number of hours varying between about 860 and 1150 per annum, allowing for two weeks' vacation. For the purpose of this study, 900 hours' flying per annum is assumed. Stewardesses customarily fly under similar time limitations and the same figure of 900 hours is assumed for their annual flying time. Dividing the assumed annual salary by the number of flying hours, yields the cost per hour. Dividing again by the block speed V_b gives the cost per mile, as indicated in Tables I and II.

Table I

Crew Member	*Pilots*					*Stewardesses*
Monthly Salary	\$250	300	350	500	650	150
Annual Flying Hours	900	900	900	900	900	900
Cost per mile \$	$\frac{3.33}{V_b}$	$\frac{4}{V_b}$	$\frac{4.67}{V_b}$	$\frac{6.67}{V_b}$	$\frac{8.67}{V_b}$	$\frac{2}{V_b}$

Table II

Aircraft Gross Weight	*Crew Assumed*	*Crew Salary Costs per mile flown*
0 to 5,000 lb.	1 Pilot at \$250.00	\$ $3.33/V_b$
5,000 to 10,000 lb.	2 Pilots at \$300.00	$8.0/V_b$
10,000 to 15,000 lb.	2 Pilots at \$500.00 and \$300.00	$10.67/V_b$
15,000 to 45,000 lb.	2 Pilots at \$650.00 and \$350.00, 1 Stewardess	$15.34/V_b$
Over 45,000 lb.	2 Pilots at \$650.00 and \$350.00, 2 Stewardesses	$17.34/V_b$

The block speed is defined as the distance between terminals divided by the time from passenger ramp to passenger ramp. Mentzer and Nourse in their original study simplified the calculation of block speed by assuming the following:

Flight altitude—14,000 ft.	Terminal altitudes—sea level
Wind velocity—zero	Time lost in climb and descent—0.06 hour
Taxi and manoeuvring time—0.20 hour	

Block distance is increased by 2% to allow for inaccuracies in flying and necessary deviations in course.

The equation for block speed is then—

$$V_b = \frac{D}{(1.02\ D/V_c) + 0.26}$$

Where V_b is block speed in mi. per hr.
D is the trip length or block distance in miles
V_c is the level flight cruising speed at altitude, in mi. per hr.

This formula for block speed is reasonably accurate for most purposes.

In making this study it is assumed that the relationship between the number of crews and the number of aircraft is such that all flying personnel can complete their 900 hours annually irrespective of the utilization assumed (hours flown per annum per aircraft).

Since this study is intended to refer to domestic operations as currently performed, no allowance is made for the fact that aircraft on transoceanic flights would need the addition of a navigator and radio operator and the substitution of stewards for stewardesses. This would increase the crew pay costs per mile in the case of the heavier aircraft, over 45,000 lb. gross weight.

2. Flying personnel supplies and expenses

Included in this item are a host of miscellaneous expenses, such as, hotels, meals, taxis, travelling, training, transfers, etc., and the only source for estimating such costs lies in the past experience of the airlines. In the United States, 35c to 45c per hour flown will account for this cost for each crew member. In Canada this item is higher, being of the order of 70c per hour flown per crew member.

In this study it is assumed that for aircraft of gross weight less than 15,000 lb. the cost per hour is 40c per crew member and for aircraft of gross weight exceeding 15,000 lb. the cost per hour for this item is 70c per crew member.

Table III accordingly gives the costs per mile for this item.

Table III

Aircraft Gross Weight	*Cost per mile for Crew Supplies and Expenses*
0 to 5,000 lb.	\$$0.4/V_b$
5,000 to 15,000 lb.	$0.8/V_b$
15,000 to 45,000 lb.	$2.1/V_b$
Over 45,000 lb.	$2.8/V_b$

3. Aircraft engine fuel cost

The formula used by Mentzer and Nourse for estimating fuel costs assumes a specific fuel consumption (cruising) of 0.45 lb. per brake horsepower per hour which they considered the best obtainable with modern engines (1940) operated at 50 per cent of take-off power.

A study of the fuel consumed and miles flown by several of the major airlines (including Trans-Canada Air Lines) indicates that the average value of the Imperial gallons of fuel consumed per mile flown is given by the following formula—

$$\text{Imp. gals. per mile} = 0.0771\ \frac{H.P._c}{V_c}$$

Where $H.P._c$ is the total horsepower used for cruising and V_c is the cruising speed in mi. per hr.

For any of the individual airlines, the variation from the mean of the annual estimate of gallons per mile seldom exceeded ± 3 per cent over a three-year period (1942-45). Averaging the value for each airline over this three-year period indicated a maximum variation among the different airlines of about ± 4 per cent from the mean value of 0.0771 given in the above equation.

The above formula indicates a specific fuel consumption of

$$7.2 \times 0.0771 \cdot \frac{V_b}{V_c} \text{ or } 0.555 \ \frac{V_b}{V_c} \text{ lb./B.H.P./hr.}$$

Where V_b is an overall average block speed.

Assuming an average fuel cost in Canada of 28.0 cents per gallon the equation for fuel costs per mile reduces to—

$$\text{Fuel cost per mile flown} = \$0.0216 \cdot \frac{H.P._c}{V_c}$$

In general, the fuel cost per mile is the largest single item of direct operating expense in Canada and should therefore be computed with appropriate precision. For general purposes it is felt that the above equation is accurate to within a few per cent. For specific flight operations it might be possible to make an even more exact estimate of fuel consumption and costs if so desired.

4. AIRCRAFT ENGINE OIL COST

A study of aircraft engine oil consumption figures during recent years for a number of the airlines indicates that the gallons consumed per mile flown can be approximately represented by the following equation:

$$\text{gal./mile} = 0.00109 \cdot \frac{H.P._c}{V_c}$$

This equation indicates a specific oil consumption of—

$0.0098 \cdot \frac{V_b}{V_c}$ lb./B.H.P./hr. Where V_b is again an average block speed. Mentzer and Nourse considered 0.01 lb./B.H.P./hr. as a reasonable approximate cruising specific consumption for known engines.

Assuming an average oil cost in Canada of 80.0 cents per gallon—

$$\text{Oil cost per mile flown} = \$0.00087 \cdot \frac{H.P._c}{V_c}$$

5. PASSENGER SUPPLIES, MEALS AND INTERRUPTED TRIP EXPENSES

As with item 2, the only source of information for the computation of this item is the accumulated experience of the airlines.

This expense varies considerably from year to year and increases as aircraft size increases. Fortunately, it only represents about 5 per cent of the total of the direct operating expenses.

An arbitrary scale based to some extent on past experience in Canada is assumed, as given in Table IV.

TABLE IV

Aircraft Gross Weight	*Cost per Mile Flown*
0 – 5,000 lb.	\$ 0.0005 . N_p
5,000 – 10,000 lb.	.0015 . N_p
10,000 – 15,000 lb.	.0020 . N_p
15,000 – 20,000 lb.	.00275. N_p
20,000 – 40,000 lb.	.0035 . N_p
40,000 – 80,000 lb.	.0045 . N_p
over 80,000 lb.	.0055 . N_p

N_p = number of passengers carried

6. AIRCRAFT SERVICING COST FOR LABOUR AND SUPPLIES

This item is of the order of 10 per cent of the total direct operating costs. Mentzer and Nourse indicate that it is difficult to estimate accurately this item, partly because it is not directly associated with any particular aeroplane characteristic and partly because fluctuations of servicing costs are difficult to explain even by airline servicing experts. Included in this item is the labour in washing and cleaning (including the aircraft interior) and in periodically inspecting and checking the airframe and engine, together with materials expended in servicing.

Following the lead given by Mentzer and Nourse and adopted with slight variation in most subsequent studies, the cost of aircraft servicing is assumed to vary, partly with the number of engines and partly with the aircraft empty weight less the weight of the engines. A formula giving effect to this is assumed as follows—

$$\text{Cost/mile flown} = \$ \frac{9.0}{3\,V_b} \left(N_e + \frac{W_a}{10{,}000} \right)$$

Where N_e is the number of engines per aircraft, W_a is the aircraft empty weight less weight of engines and \$9.0 is the sum, in Canada, of the labour and material costs for servicing, per hour flown, by a twin-engined aircraft for which W_a = 10,000 lb. This figure for costs per hour flown is derived directly from airline experience in Canada.

This formula assumes that each engine and the airframe itself contribute equally to the cost of servicing, the contributions being proportional directly to the number of engines and the empty weight less engine weight, respectively.

For typical existing aircraft, W_a is approximately 55 per cent of the gross weight (W_g). The cost equation can accordingly be reduced to—

$$\text{Cost/mile flown} = \$ \frac{3.0}{V_b} \left(N_e + 0.55 \ \frac{W_g}{10{,}000} \right)$$

7. AIRCRAFT REPAIR COSTS FOR LABOUR AND MATERIALS

This cost item covers overhaul and repair expenses of the aircraft, excluding engines and propellers, radio,

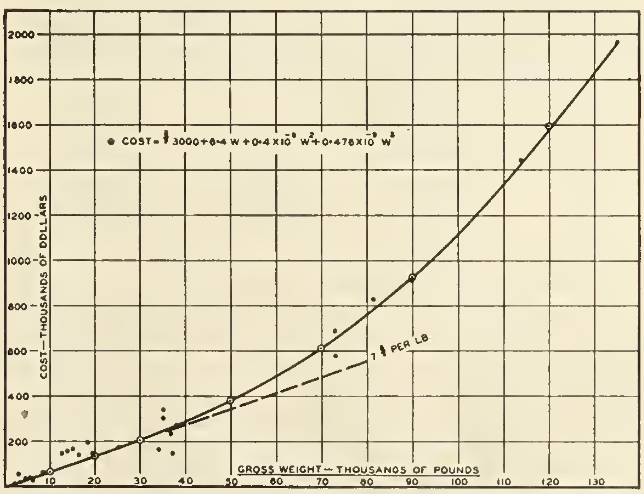

Fig. 1—The initial cost in Canada of aircraft of various gross weights—solid points represent actual aircraft, circles satisfy mathematical equation.

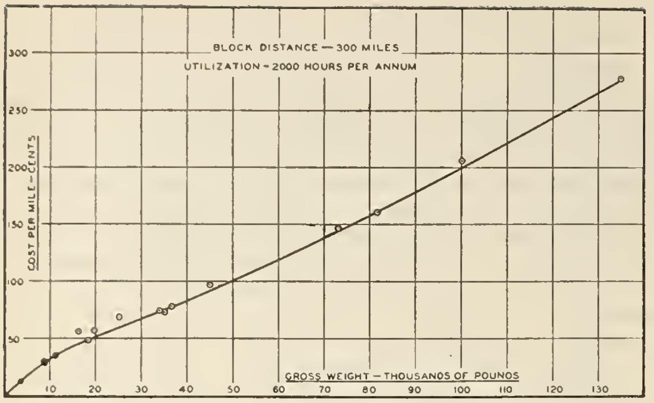

Fig. 2—The direct operating cost per mile for aircraft of various gross weights for a block distance of 300 miles, at an annual utilization of 2000 hours. This curve shows the typical scatter of points.

instruments and miscellaneous flying equipment and is the sum of labour and supplies costs.

It is assumed that the labour costs depend on the number of engines and on the size of the aircraft as indicated by the wing area. The size of the aircraft is assumed to control half the overhaul and repair labour costs and the presence of each engine is assumed to contribute 25 per cent of the labour costs.

The material costs are assumed to depend to an equal extent on the empty weight of the aircraft less engines, propellers, radio and miscellaneous equipment, and on the initial cost of the aircraft less these items. Now for a typical existing aircraft this weight and cost can be expressed in terms of the gross weight and initial cost (C_a) of the whole aircraft, figures which are more readily available, as follows—

Weight of empty aircraft less engines, propellers, radio and miscellaneous equipment $= 0.463\ W_g$

Cost $= 0.665\ C_a$

A formula expressing these costs in this manner is then—

$$\text{Cost/mile} = \frac{1}{2V_b} \cdot \left\{3.65\left(\frac{N_e}{2} + \frac{S}{550}\right) + 3.55\left(\frac{0.463\ W_g}{9028} + \frac{0.665\ C_a}{103{,}900}\right)\right\}$$

Where S is the wing area in sq. ft. and \$3.65 is the aircraft repair labour costs per hour flown and \$3.55 is the aircraft repair material costs per hour flown in Canada for the typical aircraft for which the number of engines (N_e) is two, the wing area is 550 sq. ft. and the weight and cost of the aircraft less engines, propellers, etc., are 9028 lb. and \$103,900 respectively.

This formula reduces to—

$$\text{Cost/mile} = \$\frac{1}{V_b}\left\{0.9125\ N_e + 0.3318\ .\ \frac{S}{100} + \left(\frac{0.9102\ W_g + 0.1136\ C_a}{10{,}000}\right)\right\}$$

It is realized that some loss in accuracy may result from the inclusion of constants relating component weights and costs to gross weight and total cost, with the assumption that these constants will not change for different aircraft. It is expected that these constants will vary with design changes and with increasing size. It is not considered, however, that the change will have very profound effect on the cost estimated by the above equation. The constants in any case may be changed to suit any specific aircraft, if the relevant information is available.

Wing area in the above equation is preferred to floor area of cabin or number of seats, as used in the equations developed by others, since it is more readily known and is equally applicable.

The cost of the complete aircraft (C_a) is not always readily obtainable, even in a manufacturers' brochure. A study of the meagre information available on the initial cost of modern aircraft in Canada indicates considerable scatter, when plotted as initial cost against empty weight. For empty weights below 25,000 lb., a figure of \$12 per lb. of empty weight appears to be a good mean assumption for initial cost. There is often considerable doubt as to just what is included in empty weight and it becomes much easier to use the gross weight. Plotting initial cost as a function of gross weight indicates about the same degree of scatter. For gross weights below 40,000 lb., a figure of \$7 per lb. of gross weight is a fair assumption for initial cost. Thereafter, the initial cost rises rapidly with increasing gross weight, as indicated in Fig. 1.

A formula which closely fits the assumed curve is given by—

$$\text{Cost in dollars} = 3000 + 6.4W + 0.4 \times 10^{-6}\ .\ W^2 + 0.476 \times 10^{-9} . W^3$$

Where W = Gross weight in lb.

If information on initial price is lacking, this relationship will provide an approximate estimate for use in an operating cost analysis.

8. ENGINE AND PROPELLER REPAIR COSTS FOR LABOUR AND SUPPLIES

As in the case of aircraft servicing and aircraft overhaul and repair, the airlines have accumulated extensive experience in estimating engine and propeller repair costs for twin-engined equipment.

Engine repair costs for labour and material are, of course, directly proportional to the number of engines per aircraft. The labour costs for engine repair are assumed to be equally influenced by the weight per engine and the number of cylinders per engine. The material costs for engine repair are considered to be equally affected by the weight per engine and the initial cost of one engine.

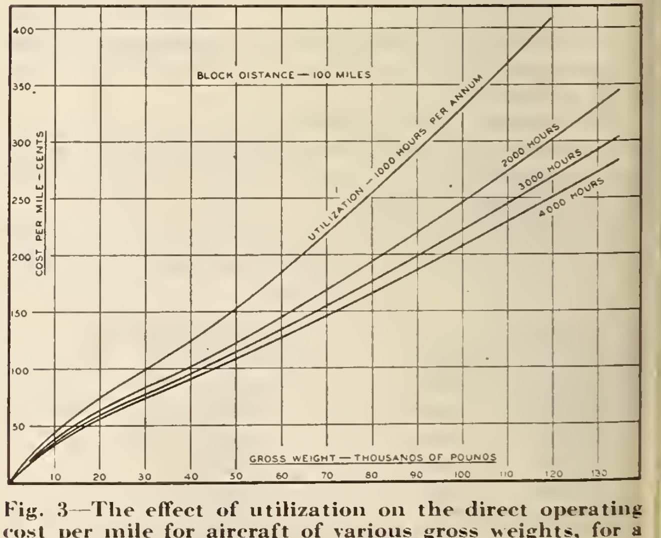

Fig. 3—The effect of utilization on the direct operating cost per mile for aircraft of various gross weights, for a block distance of 100 miles.

A formula expressing these relationships is—

$$\text{Cost/mile} = \frac{N_e}{2\ V_b}\left\{1.53\left(\frac{W_e}{1400}+\frac{N_c}{14}\right) + 2.97\left(\frac{W_e}{1400}+\frac{C_e}{16{,}990}\right)\right\}$$

Where W_e = weight per engine
N_c = number of cylinders per engine
C_e = initial cost per engine

\$1.53 and \$2.97 are the labour and material costs per hour flown, respectively, for the repair of a 14 cylinder engine of 1400 lb. weight and costing initially \$16,990. These cost figures are derived from Canadian airline experience.

This equation is similar in form to that developed by Mentzer and Nourse in their original study. Subsequent studies by others continue to adopt this method for the analysis of engine repair costs.

Mentzer and Nourse had no separate equation for propeller overhaul and repair costs and it is presumed that this item was included either in the aircraft overhaul costs or the engine repair costs.

Trans-Canada Air Lines has developed an equation for predicting propeller repair costs as follows—

Propeller repair costs are assumed to vary directly with the number of propellers (here assumed equal to the number of engines). Labour costs per hour flown are assumed to be constant at \$0.20, based on Canadian experience but material costs for propeller repairs are assumed to be equally influenced by propeller weight and propeller cost, as indicated in the following equation

$$\text{Cost/mile} = N_e\left\{\frac{0.008}{2}\left(\frac{W_p}{376}+\frac{C_p}{3931}\right)+0.20\right\}$$

Where W_p = Weight per propeller
C_p = Cost per propeller

and \$0.008 is the material cost per hour flown for the repair of a propeller weighing 376 lb. and costing \$3931, derived from Canadian airline experience.

These two equations are combined to give the total repair costs for engines and propellers. The combined equation can be considerably simplified by the following assumptions, which are true for the Canadian airline aircraft and sufficiently typical of most aircraft to be allowable in a study of this nature.

$W_e = 1.333\,P_r$
$C_e = 12.14\,W_e$
$W_p = 0.358\,P_r$
$C_p = 10.45\,W_p$

Where P_r = Rated power per engine

With these substitutions, the equation for engine and propeller repair costs becomes—

$$\text{Cost/mile} = \$\ \frac{N_e}{V_b}\left\{3.565\ \frac{P_r}{1000} + 0.0546\ N_c + 0.2\right\}$$

9. OVERHAUL AND REPAIR COSTS FOR INSTRUMENTS, RADIO AND MISCELLANEOUS FLYING EQUIPMENT

The study of a few aircraft indicated that on the average the total weight of instruments, radio and miscellaneous flying equipment amounted to 3.1 per cent of the gross weight and the corresponding cost of this equipment was \$21.0 per lb.

Canadian airline experience indicates that the labour and material costs per hour flown for this repair item are \$1.373 and \$0.951, respectively. Assuming that the labour costs are proportional to the weight of the equipment and the material costs depend on the weight and cost of the equipment, that is, on the weight, since cost is proportional to weight, then—

$$\text{Cost/mile} = \frac{1}{V_b}\left\{1.373\left(\frac{0.031\ W_g}{605}\right) + 0.951\left(\frac{0.031\ W_g}{605}\right)\right\}$$

Where 605 is the value of 0.031 W_g for the Canadian airline aircraft for which the hourly cost figures have been quoted.

This equation reduces to—

$$\text{Cost/mile} = \$\ \frac{0.119}{V_b}\cdot\frac{W_g}{1000}$$

10. FLYING EQUIPMENT INSURANCE

Premiums for the insurance of flying equipment are approximately 10 per cent of the insured value. Assuming that the aircraft is insured for its full initial value—

$$\text{Cost/mile} = \$\ \frac{0.1\ C_a}{V_b\ .\ U}$$

Where U is the utilization in hours flown per annum

11. LIABILITY AND PROPERTY DAMAGE INSURANCE

The minimum insurance required by the Air Transport Board is:

Public liability	\$20,000 one person	\$40,000 total
Property damage	\$ 5,000	
Passenger liability	\$20,000	

Typical premiums are shown in Tables V, VI and VII.

It is assumed for the purpose of this study that the following insurance is carried—

TABLE V
Public Liability

Amount	*Premium*
5/10	\$15.00
10/20	18.75
20/40	22.20
25/50	23.40
50/100	27.60
100/200	29.85

TABLE VI
Property Damage

Amount	*Premium*
\$ 5,000	\$17.50
10,000	19.78
15,000	21.53
20,000	22.75
25,000	23.98
50,000	28.00
75,000	30.63
100,000	32.03

TABLE VII
Passenger Liability

Number of Seats / *Amount*	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*
\$ 5,000	\$ 75.00	110.00	145.00	175.00	205.00	235.00	265.00	295.00	325.00
10,000	102.00	149.60	197.20	238.00	278.80	319.60	360.40	401.20	442.00
20,000	124.50	182.60	240.70	290.50	340.30	390.10	439.90	489.70	539.50
25,000	127.50	187.00	246.50	297.50	348.50	399.50	450.50	501.50	552.50
50,000	137.25	201.30	265.35	320.25	375.15	430.05	484.95	539.85	594.75

Aircraft Gross Weight	*Public Liability*	*Property Damage*	*Passenger Liability*
0 to 10,000 lb.	\$ 20/ 40,000...	\$ 5,000	\$20,000
10,000 to 18,000 lb.	50/100,000...	50,000	25,000
Above 18,000 lb.	100/200,000...	100,000	50,000

The cost per mile flown for public liability and property damage insurance is therefore, from Tables V and VI—

Aircraft Gross Weight	*Cost/mile*
0 to 10,000 lb.	\$ $39.70/UV_b$
10,000 to 18,000 lb.	$55.60/UV_b$
over 18,000 lb.	$61.88/UV_b$

For passenger liability the insurance cost/mile is—

$$\text{Cost/mile} = P/UV_b$$

Where P is the premium given below deduced from Table VII (100% occupancy is assumed)

Number of Seats	*Gross Weight* 0—10,000 lb.	10,000—18,000 lb.	over 18,000 lb.
1	\$124.50	127.50	137.25
2	182.60	187.00	201.30
3	240.70	246.50	265.35
each additional seat	49.80	51.00	54.90

As most aircraft under consideration will have more than three seats, the total cost/mile for public liability, property damage and passenger liability can be written as follows—

Aircraft Gross Weight	*Cost/mile*
0—10,000 lb.	$1/UV_b \left\{39.70+240.70+(N_p-3)49.80\right\}$
10,000—18,000 lb.	$1/UV_b \left\{55.60+246.50+(N_p-3)51.00\right\}$
Over 18,000 lb.	$1/UV_b \left\{61.88+265.35+(N_p-3)54.90\right\}$

Where N_p = number of passenger seats

For employer's liability insurance, airline experience in Canada indicates a cost/mile formula as follows—

$$\text{Cost/mile} = \frac{1}{UV_b}\left(I_e \cdot \frac{12C_p}{100} + I_g \cdot \frac{V_i}{100}\right)$$

Where I_e = Employer's liability insurance percentage rate on crew payroll. Assume 3%

C_p = Crew monthly payroll

I_g = Flight risk group insurance percentage rate on insured value of crew. Assume 1%

V_i = Insured value of flying crew. Assume \$5000 for pilots and \$3000 for stewardesses.

Cost per mile for this item therefore reduces to the figures given in the following table—

Aircraft Gross Weight	C_p	V_i	*Cost/mile*
0 to 5,000 lb.	250	5,000	$140/UV_b$
5,000 to 10,000 lb.	600	10,000	$316/UV_b$
10,000 to 15,000 lb.	800	10,000	$388/UV_b$
15,000 to 45,000 lb.	1150	13,000	$544/UV_b$
over 45,000 lb.	1300	16,000	$628/UV_b$

Combining all four insurance costs—public liability and property damage, passenger liability and employer's liability, the cost per mile is given in Table VIII.

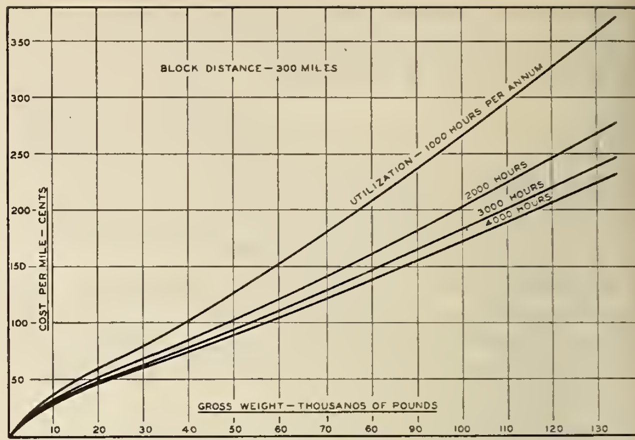

Fig. 4—The effect of utilization on the direct operating cost per mile for aircraft of various gross weights, for a block distance of 300 miles.

Table VIII
Insurance Costs per Mile

Aircraft Gross Weight	*Cost/mile \$*
0— 5,000 lb.	$1/UV_b\left\{420.40+ (N_p-3)\,49.8\right\}$
5,000—10,000 lb.	$1/UV_b\left\{596.40+ (N_p-3)\,49.8\right\}$
10,000—15,000 lb.	$1/UV_b\left\{690.10+ (N_p-3)\,51.0\right\}$
15,000—18,000 lb.	$1/UV_b\left\{846.10+ (N_p-3)\,51.0\right\}$
18,000—45,000 lb.	$1/UV_b\left\{871.20+ (N_p-3)\,54.9\right\}$
Over 45,000 lb.	$1/UV_b\left\{955.20+ (N_p-3)\,54.9\right\}$

12. AIRCRAFT DEPRECIATION COSTS

The aircraft depreciation cost per mile is equal to the initial cost of the aircraft (which excludes engines, propellers, communication equipment and miscellaneous flying equipment) less the residual value, divided by the total miles flown during the life of the aircraft. An equation expressing this cost is therefore—

$$\text{Cost/mile} = \$\left(\frac{0.665\ C_a - Z}{U\ L\ V_b}\right)$$

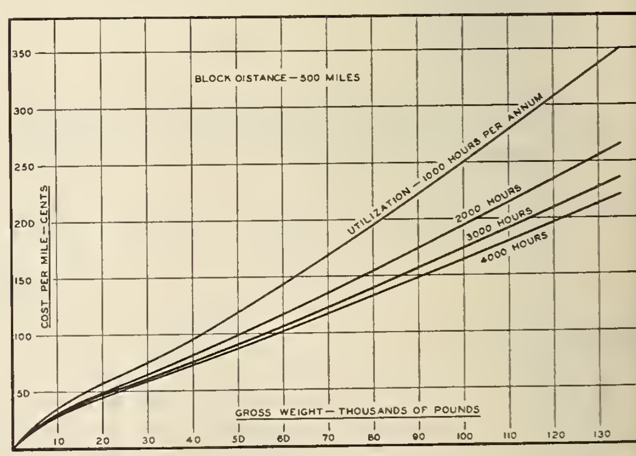

Fig. 5—The effect of utilization on the direct operating cost per mile for aircraft of various gross weights, for a block distance of 500 miles.

Where 0.665 is the proportion of the initial cost of the complete aircraft assumed to be applicable to the aircraft less engines, propellers, communication equipment and miscellaneous flying equipment. This figure applies to a typical airline aircraft in Canada and is not likely to be much in error for existing types of transport aircraft.

Z = residual value of the aircraft less engines, propellers, etc. Assume $Z = 0.10\ (0.665\ C_a)$

L = Aircraft life in years. Assume $L = 6$

With these assumptions the equation reduces to—

$$\text{Cost/mile} = \$\ \frac{0.0998\ C_a}{U V_b}$$

13. AIRCRAFT ENGINE AND PROPELLER DEPRECIATION

It is assumed that the engine depreciation period or life is 6000 hours, with a residual value of 5 per cent of the initial cost. The initial cost is assumed to be \$12.14 per lb. of weight and the weight is assumed to be 1.333 lb. per rated horsepower as assumed in the equation for engine repair costs.

Engine depreciation cost/mile is then—

$$\frac{N_e\ .\ 0.95\ .\ 12.14\ (1.333\ P_r)}{6000\ V_b} = N_e \frac{0.00256}{V_b} P_r$$

Propeller depreciation period is assumed to be 7000 hours with a residual value of 0.3 of the initial value. This is equivalent to a life of 10,000 hours with no residual value. This assumption is based on Canadian airline experience.

Initial cost is assumed, as before, to be \$10.45 per lb. of propeller weight and propeller weight is assumed to be equal to 0.358 P_r.

$$\text{Cost/mile is then } \frac{N_e\ .\ 10.45\ .\ 0.358\ P_r}{10{,}000\ V_b}$$

Simplifying this and combining with the engine depreciation cost we have a total engine and propeller depreciation cost of—

$$\text{Cost/mile} = \$\ 0.00294\ \frac{N_e\ .\ P_r}{V_b}$$

14. DEPRECIATION OF INSTRUMENTS, RADIO AND MISCELLANEOUS FLYING EQUIPMENT

Based on Canadian experience, instruments are assumed to be depreciated over a 6-year period, radio and miscellaneous flying equipment over a 5-year period, with no residual values.

In this study it is assumed that instrument weight is ½ per cent of gross weight and instrument cost is \$36 per lb.

Instrument depreciation cost/mile is therefore

$$0.03\ \frac{W_g}{U\ V_b}$$

Radio and miscellaneous equipment is assumed to weigh 2.4 per cent of gross weight and to cost \$18.50 per lb., giving a depreciation

$$\text{Cost/mile of } 0.089\ .\ \frac{W_g}{U\ V_b}$$

The total depreciation cost is therefore

$$\text{Cost/mile} = \$0.119\ \frac{W_g}{U\ V_b}$$

ILLUSTRATIVE EXAMPLE OF THE USE OF THE FORMULAE

In order to show the absolute and relative magnitudes of the various items which constitute the direct operating costs in a typical case, an example is considered below.

Assumptions:

Block distance—300 miles
Utilization—2000 hours per annum
W_g —Gross weight—25,200 lb.
S —Wing area—987 sq. ft.
N_e —Number of engines—2
N_c —Number of cylinders per engine—14
P_r —Rated power per engine—1050 hp.
C_a —Initial cost of complete aircraft—\$173,000 in Canada
$H.P._c$—Total cruising horsepower—1200 hp.
V_c —Cruising speed—186 m.p.h. (at 10,000 ft.)
V_b —Block speed—158 m.p.h.
N_p —Number of passengers carried—21

Inserting the values of these quantities in the various formulae for the direct operating cost items yields the results given in Table IX.

TABLE IX

Item of Direct Operating Cost	Cost per Mile cents	% of Total (approx.)
1 Flying personnel salaries...	9.71	14
2 Flying personnel supplies and expenses............	1.33	2
3 Aircraft engine fuel.......	13.93	20
4 Aircraft engine oil........	0.56	1
5 Passenger supplies, meals, interrupted trip expenses..	7.35	11
6 Servicing of aircraft—labour and supplies............	6.43	9
7 Repair of aircraft—labour and materials............	5.92	8.5
8 Repair of engines and propellers—labour and supplies	5.96	8.5
9 Repair of instruments, radio, miscellaneous equipment..................	1.90	3
10 Insurance of flying equipment..................	5.47	8
11 Insurance for liability and property damage.........	0.59	1
12 Depreciation—aircraft....	5.46	8
13 Depreciation—engines and propellers..............	3.90	6
14 Depreciation—instruments, radio, miscellaneous equipment..................	0.95	1
Total cost per mile.....	69.46 cents	

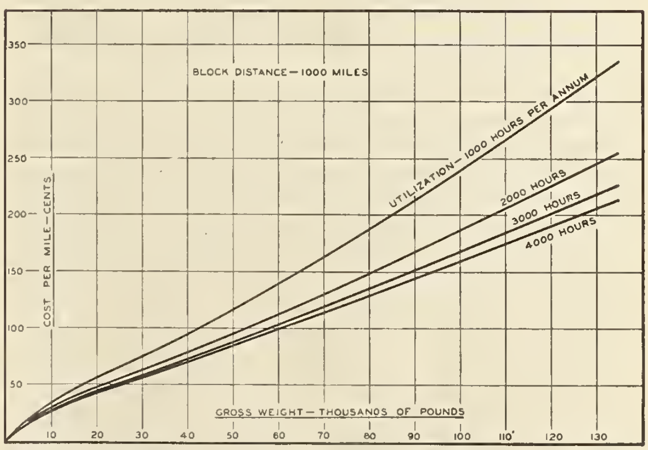

Fig. 6—The effect of utilization on the direct operating cost per mile for aircraft of various gross weights, for a block distance of 1000 miles.

Variation of Direct Operating Costs with Increasing Gross Weight

In order to show the trend of direct operating costs, as the size and weight of aircraft are varied, the formulae have been used to calculate the direct operating costs for a number of existing and projected aircraft, the gross weight of which range from 3500 lb. to 135,000 lb., as follows:

Aircraft No.	*Gross weight lb.*	*Aircraft No.*	*Gross weight lb.*
1	3,500	9	34,000
2	8,500	10	35,000
3	8,750	11	36,600
4	11,000	12	45,000
5	16,240	13	73,000
6	18,350	14	81,500
7	19,500	15	100,000
8	25,200	16	135,000

The costs have been computed for block distances of 100, 200, 300, 400, 500, 750 and 1000 miles and for utilizations of 1000, 2000, 3000 and 4000 hours per annum.

Wherever available, reliable flight test data has been used for the assumptions regarding $H.P._c$ the cruising power and V_c the crusing speed. Wherever possible, a cruising power close to 60 per cent of rated power (maximum except take-off) and the cruising speed at or close to 10,000 ft. have been used in the calculations.

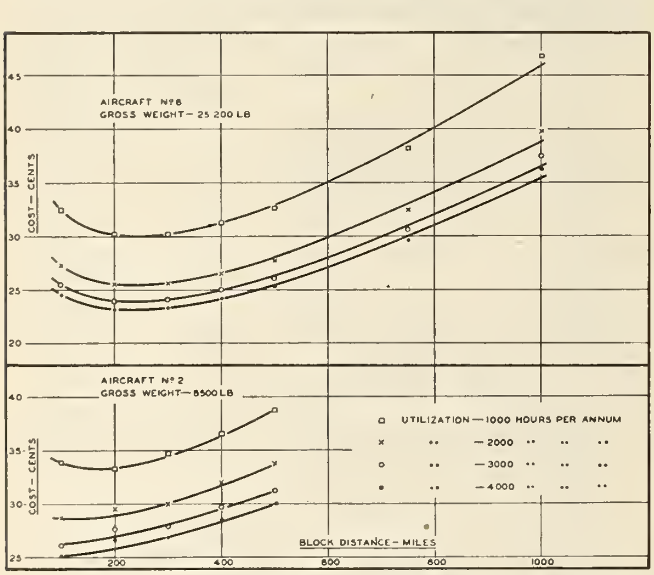

Fig. 7—The effect of block distance on the direct operating cost per payload ton-mile for aircraft No's 2 and 8, at annual utilizations of 1000, 2000, 3000 and 4000 hours.

In the case of projected aircraft, manufacturers' estimates of performance have been used.

Figure 2 shows a plot of the direct operating costs per mile for the sixteen aircraft listed above, when used over a block distance of 300 miles and at a utilization of 2000 hours per annum.

Aircraft No's 5, 7 and 8 all fall somewhat above the faired curve. Since No. 5 is a four-engined aircraft and all others below 70,000 lb. gross weight are twin-engined machines, it would be expected that the operating costs for this case would be somewhat higher. Aircraft servicing, aircraft repair, aircraft engine and propeller repair, and aircraft engine and propeller depreciation are all dependent on the number of engines and will therefore be slightly higher for a four-engined aircraft than for a comparable twin-engined one.

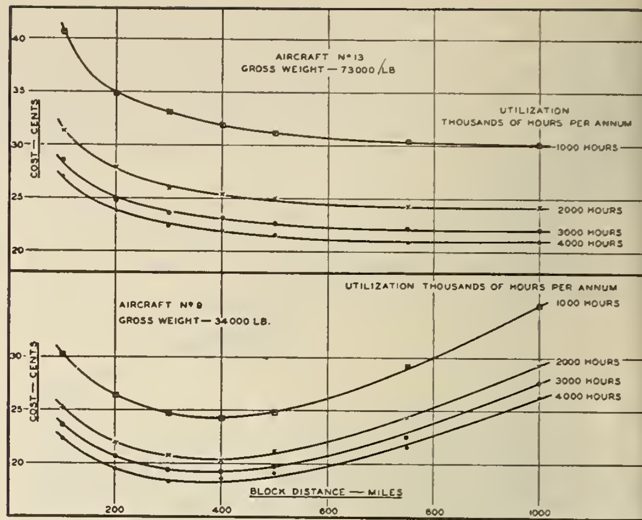

Fig. 8—The effect of block distance on the direct operating cost per payload ton-mile for aircraft No's 9 and 13, at annual utilizations of 1000, 2000, 3000 and 4000 hours.

Aircraft No's 7 and 8 are becoming obsolescent and it is not surprising that their costs appear slightly higher than those of more modern aircraft. The curve is based on twin-engined aircraft, except above 70,000 lb. gross weight where the points refer to four-engined types. With existing piston engines and commonly used power loadings, aircraft over 50,000 or 60,000 lb. gross weight would be equipped with four engines. With this in mind, the curve represents the trend of direct operating costs for modern aircraft.

Figures 3, 4, 5 and 6 give the results of the calculations of direct operating costs for the sixteen aircraft considered, for block distances of 100, 300, 500 and 1000 miles and for utilizations of 1000, 2000, 3000 and 4000 hours per annum. For the sake of clarity the individual points have been omitted, the scatter of the points being similar to that shown in Fig. 2. These charts indicate the reduction in direct operating costs per mile consequent upon increasing the utilization figure, being particularly marked at low utilization and less significant at high utilizations. They also show the decreasing gains in cost per mile to be derived from increased block distances (due solely to the resulting increase in block speeds at constant cruising speed).

Since airline revenues depend on the payload ton-miles flown (the product of the payload and the

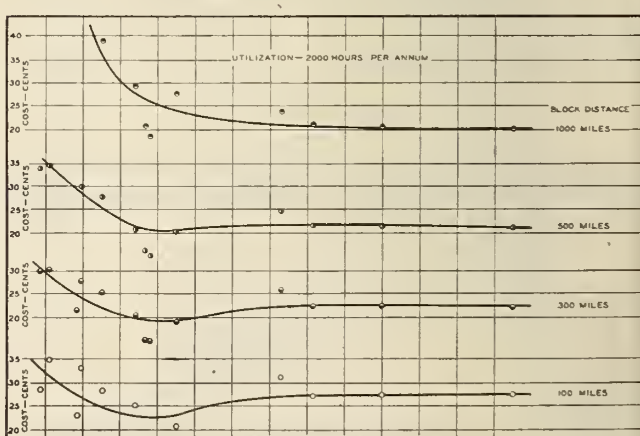

Fig. 9—The variation of direct operating cost per payload ton-mile with gross weight for block distances of 100, 300, 500 and 1000 miles, at an annual utilization of 2000 hours.

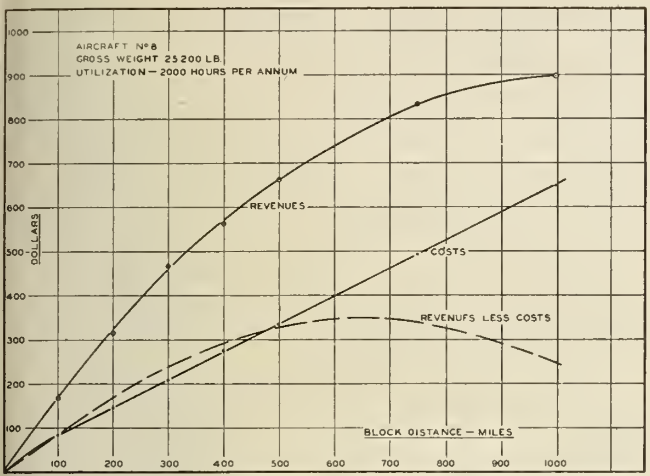

Fig. 10—The effect of block distance on the direct operating cost per trip and the revenue per trip for aircraft No. 8, at an annual utilization of 2000 hours.

distance flown) it has become customary to express the direct operating costs on a per ton-mile basis. Figures 7 and 8 show the costs per ton-mile plotted against block distance for four aircraft of gross weights ranging from 8500 to 73,000 lb. These costs per ton-mile were derived from the information given in Figs. 3 to 6 and the appropriate payload values deduced from the manufacturers' figures for disposable load. Fuel reserves were allowed for in all cases, using the commonly accepted basis, viz., a fuel allowance sufficient to fly the block distance plus 200 miles plus ¾ hour flight at cruising speed, all against a 10 mi. per hr. headwind. For the lightest aircraft, operating over the shortest block distances, it was more sensible to assume a 100 per cent reserve of fuel.

Figure 9 shows the costs per ton-mile plotted against gross weight, for the sixteen aircraft considered, for a utilization of 2000 hours per annum and for four block distances. These curves indicate that for an operation involving the transportation of a given payload over a specific block distance the economic advantage, if any, lies in the use of a number of aircraft in the 30,000-40,000 lb. class in preference to the use of a lesser number of larger aircraft, at least over block distances up to 500 miles. At a 1000-mile block distance and over, the advantage is probably with the heavier aircraft.

Returning to Figs. 7 and 8, it might be assumed that for each aircraft the point of minimum costs per ton-mile represents the optimum block distance, over which operation of the aircraft is most profitable. This is not necessarily the case and the true economic significance of block distance can only be determined from a consideration of trip costs and revenues.

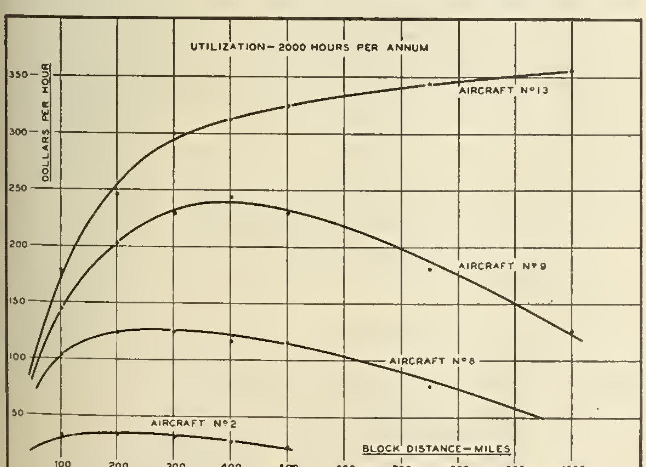

Fig. 11—The effect of block distance on the revenue less the direct operating cost, per hour flown, for aircraft No's 2, 8, 9 and 13, at an annual utilization of 2000 hours.

Figure 10 shows the relationship between trip costs for 2000 hours per annum utilization, trip revenues and block distance, for aircraft No. 8 with a gross weight of 25,200 lb. Trip costs were derived from the costs per mile (Figs. 3 to 6) multiplied by the block distance. Trip revenues were calculated on the basis of 100 per cent load factors (full payloads) at a rate of 55 cents per ton-mile, a typical value in Canada. These curves indicate that the maximum difference between revenue and cost occurs at a block distance of approximately 650 miles. However, by operating over shorter distances and refuelling, it is obviously possible to increase the total value of revenue less cost for the same utilization. The determination, therefore, of the optimum block distance for each aircraft will be made from a plot of revenue less cost, per hour flown, against block distance. This quantity is obtained by dividing the revenue less cost per trip by the trip time.

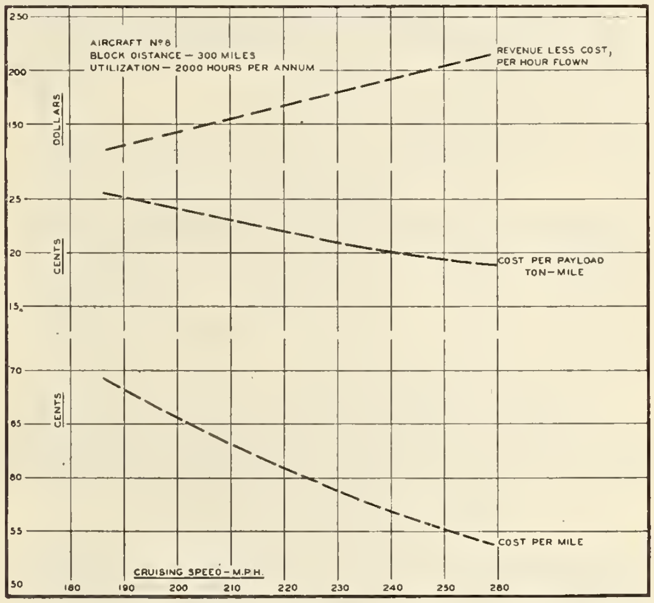

Fig. 12—The effect of increasing speed by aerodynamic improvements only, leaving the power unchanged, for aircraft No. 8 over a block distance of 300 miles, at an annual utilization of 2000 hours.

Figure 11 shows a plot of revenue less cost, per hour flown, against block distance for aircraft No's 2, 8, 9 and 13 for a utilization of 2000 hours per annum. This indicates optimum block distances of 200, 300 and 380 miles for aircraft No's 2, 8 and 9. For aircraft No. 13 the optimum block distance exceeds 1000 miles. It should be noted here that the difference between revenue and cost does not represent airline profit, as there are still the "indirect" or ground costs to be met. The optimum block distances indicated by Fig. 11 are seen to be approximately the same as the distances for minimum cost per ton-mile in Figs. 7 and 8.

Effect of Cruising Speed on Direct Operating Cost

An inspection of the various equations for direct operating costs shows that passenger supplies and expenses are independent of cruising speed; fuel and oil costs are inversely proportional to cruising speed and all other items of direct costs vary inversely with the

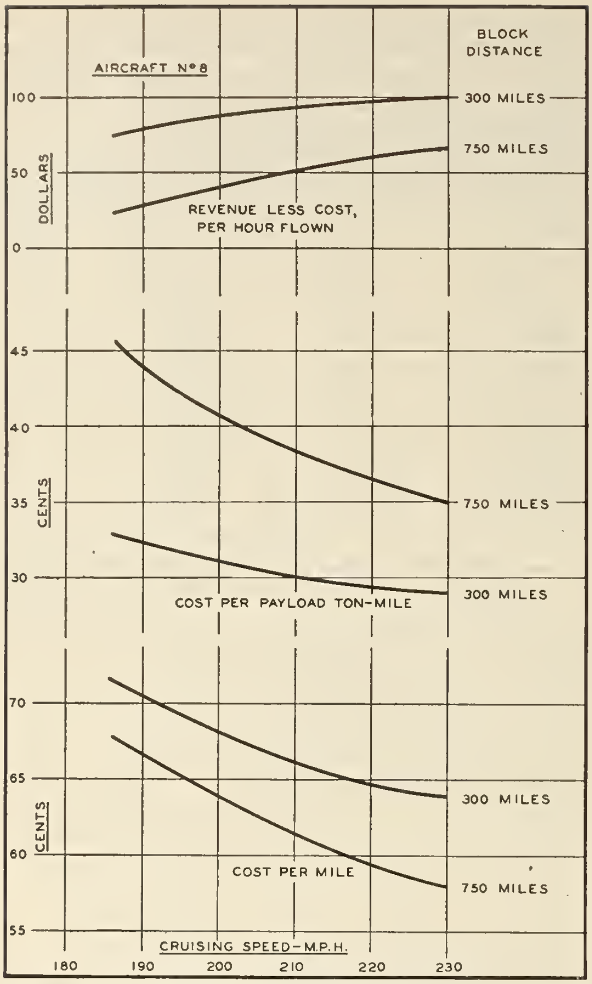

Fig. 13—The effect of increasing speed by increasing altitude only, leaving the power unchanged, for aircraft No. 8 over block distances of 300 and 750 miles, at an annual utilization of 2000 hours.

block speed and hence the cruising speed. Other things being equal, higher cruising speeds are therefore capable of yielding a reduction in direct operating costs.

If cruising speed is raised by the simple expedient of opening the throttle and using a cruising power in excess of that customarily used, which is in the neighbourhood of 60 per cent M.E.T.O. power, fuel and oil consumption will increase. Since the consumption of fuel and oil represents some 20 per cent of the total direct operating cost, an increase in this item is liable to materially reduce the advantage of increased cruising speed. The additional fuel required also tends to reduce the payload carried and hence the revenue derived. More important, possibly, than these features is the serious effect of high cruising powers on engine maintenance, reliability and life. Such a method of increasing the cruising speed in quest of greater economy must therefore be ruled out.

If the cruising speed is increased by aerodynamic refinement, so that the cruising power taken from the engines is unchanged, no adverse effects are to be expected. It is assumed that the increase in cruising speed resulting from aerodynamic improvements is, at the present state of the art, not likely to be proportionately large and therefore the possible need for increased structural strength and hence structural weight can be ignored. The reduction in block time consequent upon the increased speed of flight will reduce the fuel load somewhat, tending to increase the payload carried. In addition to this, the higher cruising speed enables more trips to be made for a given utilization, thereby further increasing the revenue, so that the overall economic picture is materially improved. Fig. 12 shows the effect of such hypothetical increases in cruising speed on the operating economics of aircraft No. 8 on a block distance of 300 miles at 2000 hours per annum utilization. For aircraft propelled by piston engines these economies are the most that could be reasonably hoped for from increased cruising speeds. The introduction of gas turbines and jet engines appears to promise considerably greater economies, not only because of greatly increased cruising speeds but because of the prospects of lower initial and maintenance costs.

Another method of increasing cruising speed is to operate at higher altitude where, for the same power expenditure, considerably greater speeds are possible because of reduced air density, particularly in the case of aerodynamically refined aircraft. At constant power, therefore, the true air speed increases with altitude but the indicated air speed decreases. Consequently, no increase in structural strength or structure weight is required on account of the increased speed. Since the power drawn from the engines is to be the same as at lower altitudes, there is no deterioration in engine reliability, life or maintenance costs. Fuel consumption at altitude may be reduced due to the reduction of exhaust back pressure, if a turbo supercharger is used. With a gear-driven supercharger, fuel consumption at altitude will be increased due to the additional power required to drive the supercharger. The further benefits due to high cruising speed, discussed in the preceding paragraph, again apply. On the debit side there is the additional fuel required at climbing power during the long climb after take-off, balanced to some extent by the descent prior to landing. The time required to attain the operating altitude, at the speed for best climb, reduces the gain in block speed which is derived from high altitude cruising, particularly on shorter block distances. Engine weight is increased by the addition of a larger supercharger to maintain power at great heights and payload must be sacrificed to allow cabin supercharging and air conditioning equipment to be carried. If a turbo supercharger is not used in preference to the gear-driven supercharger, the net power supplied to the propeller will be reduced by the power required to drive the supercharger. Propeller weight for the efficient development of thrust power at altitude will

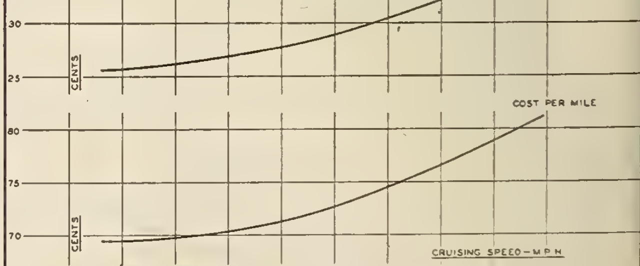

Fig. 14—The effect of increasing speed by installing engines of greater power, for aircraft No. 8 over a block distance of 300 miles, at an annual utilization of 2000 hours.

(*Continued on page 219*)

RECONSTRUCTION OF HALIFAX WATER RESERVOIR

Prestressed Concrete Dome Roof

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A paper presented recently before the Saint John, Kingston, Halifax, Quebec and Ottawa Branches of the Engineering Institute of Canada.

Because of the rapidly growing interest among members of the profession in "prestressing", a description of an actual job, and the success achieved in carrying it out, is of particular value at this time. The author shows the serious condition of the original structure, and describes the design and the methods of construction of the prestressed concrete dome roof, as well as the procedure in repairing the interior and exterior of the reservoir walls with gunite.

The City of Halifax draws its water supply from a system of lakes located a few miles outside the city. The water is carried to the city from these natural reservoirs in 24 in. and 27 in. cast iron pipe lines and distributed to the mains partly by gravity flow and partly through pumping stations located at various points within the city.

In 1917, a reservoir was built to provide storage capacity within the city and also to improve pressure conditions in the High Service district of the water system. This structure, known as the High Service reservoir, was built on a hill in the northern part of the city, the highest point available for such construction. This hill is exposed on all sides; until the Second World War, when the district was partly developed, there were few houses and no trees to protect it from the elements. In November 1917, shortly after completion of the reservoir, the Halifax explosion occurred in the Narrows, a scant half mile to the east. This blasted every tree and house from the face of the hill. Again in 1945, the magazines on Bedford Basin, a few miles to the north, across the water, caught fire and a series of violent explosions shook the city, although little or no damage was suffered by the reservoir as a direct result.

How the Original Reservoir Was Built

The reservoir was a massive concrete structure 160 ft. inside dia., 25 ft. deep, with a capacity of 3½ million gallons. The foundations were carried down about 8 ft. below grade and heavily reinforced. The floor consisted of a 6 in. slab poured with the footings, over a compacted fill, covered with another 6 in. reinforced slab, poured in place after walls and columns were built. The close spacing of the reinforcing steel and structural frames in the concrete contributed to a material extent to the eventual failure of the walls.

The roof was built as a flat cone with barely enough slope to provide for run-off of rain and melting snow. The slab was four inches thick and was carried on a series of radial concrete girders 12 in. by 20 in., and cross beams of various sizes and spans. This whole structure was in turn supported by 53 18-in. by 18-in. concrete columns, and by the walls themselves. Each girder was haunched into the walls at the outer ends and heavy caps attached them to the columns.

Disintegration Due to Frost Action and Neglect

During the years that followed the completion of the reservoir, very little maintenance work was done to correct troubles as they appeared, and the work done was ineffective and served only to cover up the real trouble for a time. The reservoir finally came up for critical inspection under the direction of the newly formed Public Service Commission. Their engineers ordered a thorough survey and inspection to determine what action should be taken in connection with this important link in the Halifax water system. In brief, their findings were these:

1. The roof was near the point of collapse. (Fig. 1). Several large sections had already fallen into the reservoir. The top surface had settled and heaved. In many places the slab had pulled away from the wall.
2. Many of the supporting beams and girders had failed, and some were deflected several feet with nothing but the reinforcing steel holding up the remaining concrete. Other beams had spalled, exposing steel which, in some cases, had completely rusted through.
3. The columns appeared to be fairly good, except that a number of the caps were fractured and some minor cracks were also in evidence in the columns themselves.
4. A four foot band 15 ft. above the floor, completely around the inside wall, was so badly eroded that the interior layer of reinforcing lay exposed.
5. The floor could not be inspected, since no provision had ever been made to completely drain the reservoir. About six to eight inches of mud and slime covered the entire floor area.
6. The exterior walls were in an even more alarming condition. (Fig. 2). Fully 50 per cent of the wall area above grade was heavily spalled. Large sections of concrete had fallen off. Many of the bars had come loose from their supports and had fallen to the ground. The concrete, which had been exposed, resembled piles of loose gravel held in place by the steel rods. There was no actual flow of water through the walls, but the concrete was damp and the steel was badly rusted.
7. The gatehouse was generally in the same condition as the rest of the structure, except that the spalling did not appear to have penetrated to as great a depth.

Fig. 1—Old roof showing failures in slab.

Fig. 2—Loose outer shell and partially exposed reinforcing.

8. Actual test measurements disclosed that in spite of the bad condition of the walls, very little loss of water was taking place. This was confirmed by test pits dug around the walls which also showed that little disintegration had taken place below ground level where the concrete was protected from frost.

The greatest single cause was probably frost action. Water penetrating from the top lodged within the concrete and alternate freezing and thawing plus rusting out of the steel did the rest. It is considered also in light of present information that the beam structure was somewhat underdesigned, which probably assisted the action of frost and water in its work of destruction.

The deterioration of the walls was much easier to analyze. This was a definite case of direct frost action. Water gradually seeped through the walls and construction joints. The water bars were not completely successful because of the poor concrete in this section. The water lodged in the porous concrete around the outer layer of steel and gradually by repeated thawing and freezing built up sufficient pressure to force off the outer layer. The freezing and thawing action proceeded unchecked, and the core between the inner and outer system of bars was attacked. This area was closely restrained however by the steel and, although it did fall out in places, it generally remained in place, crushed and broken. Some of the bars bonded to the outer shell were torn from their supports when the loosened sections, sometimes weighing several tons, fell away.

Choices Confronting New Commission

The problem which faced the Public Service Commission was whether to rebuild the reservoir or demolish it completely and build another. No other site with sufficient altitude was available. If a new unit was to be built, it would mean relying on the pumping stations alone to service a large part of the city for a considerable time, since complete demolition of the old reservoir would have to be undertaken before construction of a new one could commence. Many opinions were expressed; some claimed that it was beyond repair, others took the stand that repairs were practical and economical.

Finally, the Commission issued a general specification, with photographs and plans of the structure, and called for competitive tenders. Each contractor was obliged to submit his own detail drawings; an outline of the method he proposed to follow; a complete specification for the work and a guaranteed time schedule. The time schedule was important, as the city had to rely on pumps alone during the time the reservoir was out of service. This might have been serious in the event of a fire or mechanical trouble with the pumps.

The Method Selected for Rebuilding

The proposal selected by the Commission contained a number of features which proved to be original and of considerable value. Under the proposed design, the capacity of the reservoir was increased by half a million gallons, and the maximum head was increased by four feet, (see Fig. 3). These features represented a most desirable asset to the city's system. The reservoir was to be rebuilt inside and out by the gunite process, and a new prestressed concrete dome roof was to be erected in place of the conventional flat slab and columns.

The increase in head and capacity was found to be possible from an analysis of the stresses in the original design. After careful checking it was found that the working stresses were extremely low and could safely be increased by 15 per cent and still be well within limits of conservative design.

The work of reconstruction fell naturally into three distinct phases. Demolition of the old roof structure; restoration of the old concrete; and the construction of the new prestressed dome roof. Each of these sections will be dealt with separately, although they were carried out together as part of one operation in the field.

Equipment Needed

The equipment set up played an important part in the method specified for the job. The main power was compressed air furnished by two 365 c.f.m. air compressors. Air lines were piped to various points

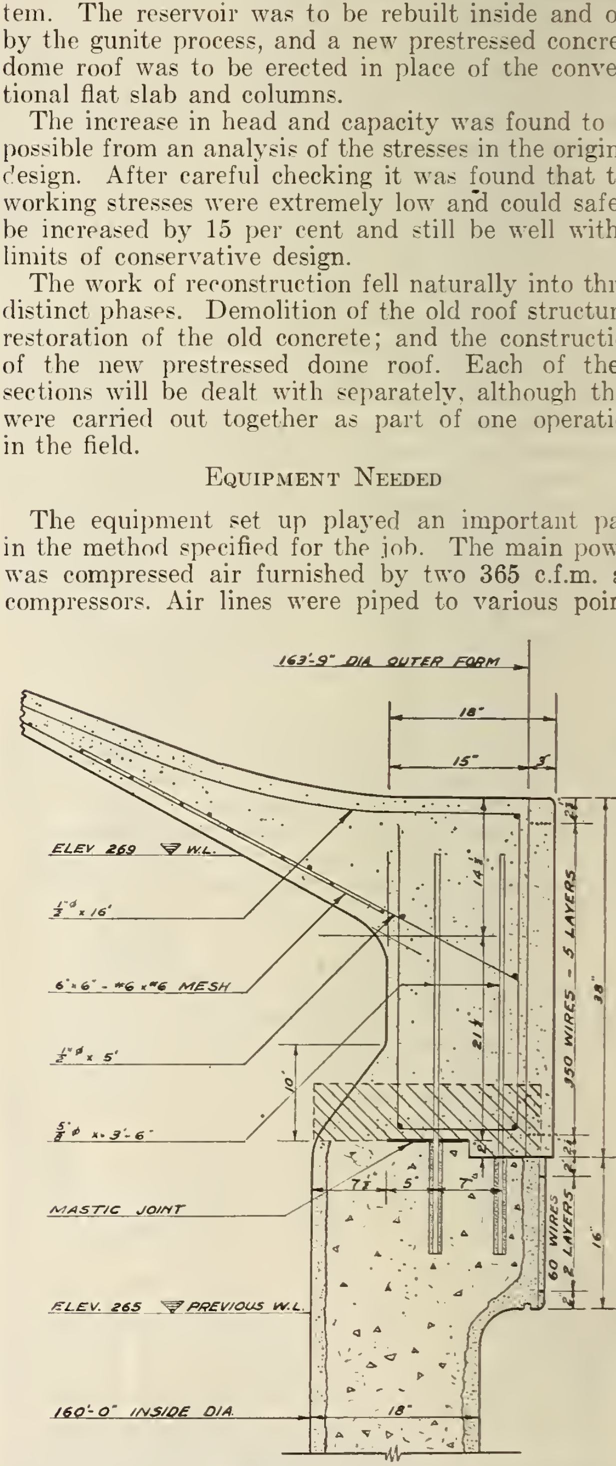

Fig. 3—Design sketch of prestressed ring and seating on old wall.

Fig. 4—Shooting gunite on dome roof.

on the job to operate the cement guns, pneumatic tools and air hoists. Heavy demolition was undertaken with standard paving breakers but the bulk of the chipping and cutting was done with six chipping tools of a new design recently developed in Canada.

An electric mixer specially fitted for the dry gunite mix fed two cement guns through screens and gravity hoppers. Each gun was equipped with modern dual hydration nozzles. Safeway scaffolds, drills, power saws, air hoists and other miscellaneous equipment also played their part. Finally the wire winding machine, commonly called the "Merry-Go-Round" completed the picture. This machine, which makes these large dome roofs possible, will be dealt with in more detail later.

Advantages of Gunite

Gunite was used in all the work. It has certain characteristics which make it particularly effective in the restoration of concrete structures such as the reservoir, and in prestressed work generally. It develops high strengths in excess of 4,000 lb. per sq. in., it is so dense that it is waterproof for all practical purposes. Forms are not usually required, and it can be finished to almost any desired lines and texture. One of its main advantages is that when applied to a properly prepared surface it develops a positive bond, which tests have shown to possess strengths in excess of the concrete to which it has been applied. It is particularly well suited to prestressed work because shrinkage and plastic flow are considerably less than in ordinary concrete.

Removal of Roof Came First

The first part of the job was the removal of the old roof. The reservoir was emptied, and the roof was marked off in sections for the three crews that carried out the work of demolition. Each crew consisted of two breaker men and four labourers. To save hoisting and unnecessary handling jumbos constructed with safeway steel scaffolds and mounted on wheels were erected inside the reservoir. A heavy wooden platform was built on the top of each jumbo. The breaking was then done over the top of these platforms; the break was discharged down a shute into trucks for disposal. Since there were over 400 tons of concrete in the roof structure, this method saved much time and rehandling. The columns were not removed, but the caps were cut off and the tops grouted over. Since they only displaced 12,000 gallons of water, it was considered uneconomical to remove them.

Repairing Interior Walls

The restoration of the interior of the reservoir began as soon as sufficient roof had been removed to permit men to work safely. Movable scaffolds were used for washing and chipping the walls. Wood scaffolds were gradually erected around the walls for chipping and gunite, as well as for later supporting the dome forms.

After the preparatory work had been completed, gunite anchors were set in the concrete at approximately 30 in. centres in each direction, and the entire area was covered with 6 in. by 6 in. electrically welded steel wire mesh, secured to the anchors with tie wires.

Immediately prior to placing each coat of gunite, the surfaces to be treated were thoroughly water blasted. The gunite was shot in two or more successive layers. On the interior walls, a minimum thickness of 1½ in. was required, but the average was higher. The final coat was screeded with straight edges, then finished with wood floats. After pumping, and cleaning the floor, it was found that on this part of the structure very little repair work was required.

Worst Damage on Exterior Walls

The work of restoration on the exterior walls, however, proved to be more difficult than anticipated. Although about 50 per cent of the area was heavily spalled and cracked, the remainder appeared to be sound except for the construction joints. However, as chipping operations proceeded, it became evident that this outer shell was not bonded to the structure and that it would have to be removed.

It was also found that the core of the wall between the inner and outer rows of steel was in very bad condition. In some cases this part of the wall fell out when the steel came away and in other cases it had to be chipped and cut to reach sound materials.

The chipping operations were followed by further cleaning and sand-blasting and setting of gunite anchors and ties. A heavy base coat of gunite was then shot, filling the holes, construction joints, and bonding in the old steel. This part of the work was then cured before further guniting to restore the original strength of the wall. The final two inches of reinforced gunite was not shot until after the reservoir was filled, in order that the walls would be under stress when the final surface was applied.

In the meantime, the tank walls were excavated down to the footings and repair proceeded on this sec-

Fig. 5—Wire winding dome roof ring.

tion. The excellent condition of this part of the wall below grade provided further evidence that the disintegration above grade was largely caused by frost action.

Gatehouse Floor Had to Be Raised

The gatehouse was gunited inside and out in the same manner as the reservoir proper. The existing floor and walls, however, were too low to accommodate the increased water level. It was necessary, therefore, to raise the upper part and build a new floor, since the water level within the gatehouse is equal to that in the reservoir. This work was completed without raising the roof elevation as there was sufficient head room available. The exterior was remodelled to harmonize with the new lines of the structure; glass block windows and a new door installed and a steel platform and ladder replaced the old concrete walkway and stair.

Recent Growth in Use of Preload Designs

The Preload design of dome roofs has been evolved over the past few years from the construction of tanks and other circular structures, which represent the first serious development of prestressed concrete work on this Continent. Very large roof spans are possible without the necessity of elaborate framing or any interior columns. At the present time, the Halifax dome is the largest of its kind in the world, 164 ft. 3 in. diameter, but several will be built in the near future exceeding two hundred feet, while others with diameters of over three hundred feet have been projected. These large spans open up entirely new fields for engineers in designing buildings of various kinds. Due to their utility and economy, particular attention has been created and designs completed utilizing this type of roof for sports arenas, aircraft hangars and other buildings where large clear floor areas are desirable.

The dome roof is simply a segment of a hollow sphere having a very thin shell enclosed by a heavy ring section. The radius of the dome surface is fixed by the amount of rise desired for the particular structure, but it has been found that for practical purposes a rise of about one eighth the diameter of the dome is most satisfactory. In Halifax the shell was 2½ in. thick and the radius about 171 ft. Obviously such a shell develops from its own dead weight plus any live load which may be imposed, tensile stress in the ring as well as meridional shear and bending stresses in the shell itself. The computation of these various stresses is extremely complex and does not form part of this article. The theories and techniques involved have been developed from a careful study of research data and tests of full size structures in the field.

How the Dome Roof Is Stressed

In the construction of the dome roof the stresses are carried by prestressing the main ring, and by the use of standard steel reinforcement. The prestressing is designed to induce sufficient compressive stresses to reverse the tensile stresses set up in the ring and shell under the maximum load condition. The bending and shear stresses, which are a maximum near the ring, are compensated for by means of standard steel reinforcing and by thickening the shell itself. The actual design used in Halifax is illustrated in Fig. 3. The seating or connection of the new dome roof to the old structure was the first consideration requiring particular attention. It was necessary to develop a positive connection between the new ring and the old structure. It was also known that some movement would take place in the ring as the compressive forces of prestressing were built up. At the same time the joint must be watertight from the inside under the hydrostatic pressure which would be developed.

Preparation for Construction

The top of the old wall was cut down to the required elevation and levelled off. A key was cut in this surface to form the joint illustrated in Fig. 3. The inside half of the joint was prevented from bonding with the ring by a ¼ in. mastic joint. This joint was later covered on the inside by overlapping the gunite lining and bonding it to the ring itself. This final operation was of course done after prestressing.

The first step in the construction of the roof was to erect a tower in the middle of the reservoir to set the centre point. Since the old walls were not truly circular, an average was taken to establish this working point. The ring forms were prefabricated on the ground in sections and set in place by instrument. A full form was used on the outside but on the inside the form was built up to the springing line of the dome only.

Forms

The dome forms were carried on a series of posts from the floor of the reservoir, set at 10 ft. centres and in concentric rings. Cross pieces were fastened across the tops of the posts at pre-determined elevations to suit the contour of the dome. Radial ribs were then laid up on these cross pieces, each rib being cut to template with the correct curvature.

Placing Steel and Shooting Gunite

The main reinforcing in the shell itself was electrically welded 6 in. by 6 in. steel wire mesh, weighing 42 lb. per hundred square feet. The mesh was supported by small chairs to locate it in the middle of the shell. Gunite was used throughout in the construction of the roof because it is best suited to prestressed construction, because it produces higher strengths than ordinary concrete, is more economical, and the loss of stress in the steel due to plastic flow and shrinkage is less.

The ring containing about 90 cu. yd. of gunite was shot first, and allowed to set for several days before shooting the shell itself. This procedure eliminates to some extent shrinkage stresses from being transmitted to the shell. The dome was then shot in a continuous operation (Fig. 4) for two cement guns, working for five and a half days.

Curing

Curing is a most important consideration, as this affects the quality of the work to a marked degree.

Fig. 6—Completed reconstruction before backfilling and grading.

The procedure followed was to place a perforated circular pipe around the ventilator curb and allow water to flow over the dome continuously. This was supplemented by revolving sprinklers. The dome was cured for two weeks before the prestressing operations commenced.

Prestressing

Prestressing was done by using a special high tensile strength wire, specially developed for this class of work. The wire was about 0.162 in. diameter in its initial state, with a yield point in excess of 180,000 lb. per sq. in. and an ultimate strength in excess of 220,000 lb. per sq. in. An initial stress of about 140,000 lb. per sq. in. was applied, to allow for loss of stress which occurs from shrinkage and plastic flow in the gunite, and from creep in the steel itself. Much research has been done on this subject and many complicated theories have been advanced as to the magnitude of this loss. In the Halifax design, a working stress of 110,000 lb. per sq. in. was used allowing for a total loss of 30,000 lb. per sq. in. from all causes. This is believed to be a conservative figure, and is borne out by experience in the field and tests in the laboratory.

Five layers of wire were applied in continuous spirals on the ring, using a total of about forty-two miles, or 12,000 lbs. Each layer of wire was bonded in immediately after winding with a thin coat of gunite and when this was set, the next layer was applied. The final layer was covered with about 1 in. of gunite for permanent protection. Two layers of wire were also wound on the remaining part ot the old ring, to induce some measure of prestress in this part of the structure and to assist in the transmission of stresses from the new work to the old.

The wire winding machine, (Fig. 5) hangs from a supporting carriage which travels on pneumatic tires around the ring. Tie cables to a centre pin extending through the centre of the dome hold the carriage to its track. The machine itself is self propelled by a gas engine operating a drum which engages an endless wire rope passing around the perimeter of the structure being prestressed. A spring-loaded take-up is provided to maintain the amount of tension required for proper traction. Vertical travel of the mechanism is obtained by hand wheels operating a simple winch device, although on the newer machine this is taken care of by automatic power drive. The preload wire is carried on a reel, mounted on the working platform. This wire is led to a die of predetermined size through which it is drawn, to develop the necessary stress in the wire. Winding of the wire starts at the bottom of the ring from an anchor set in the gunite and proceeds spirally around the circumference. Each coil of wire is joined to the following roll by means of a special torpedo splice. The machine travels at a speed of about 3 m.p.h., requiring only a few hours to actually apply the mileage of wire needed for an ordinary tank or roof.

Stripping

Following completion of the prestressing, the dome forms were stripped and removed. Water tests were then conducted by pumping in water until maximum capacity was reached. The reservoir was maintained at near capacity for a considerable time before backfilling, with no evidence of any leaks or defects appearing. The entire surface above grade was then treated with a special surfacing material of a grey-white colour to give a pleasing appearance.

Quantities Compared in Old and New Designs

There are a few figures which are interesting and which demonstrate one of the advantages of the prestressing. The original reservoir was, with the possible exception of the roof, of a conservative design. The roof, including the supporting columns contained almost 600 cu. yd. of concrete and 60,000 lb. of steel, while the new Preload roof which replaced it, including the ring, contained only 300 cu. yd. of gunite and 27,000 lb. of steel, or about half the original quantities. A comparison between total quantities in the whole reservoir and a modern prestressed design for one of similar capacity is even more startling. The old reservoir contained 2,200 cu. yd. of concrete and 522,000 lb. of steel. By comparison, a modern prestressed design of similar dimensions would contain 750 cu. yd. of gunite and only 80,000 lb. of steel; one third of the concrete and less than a sixth of the steel in the original structure.

In conclusion, this work demonstrated the efficiency of the gunite method of repairing such heavy structures, even when disintegration had proceeded to a marked degree. It also marked a major step forward in the practice of prestressed concrete construction. The Halifax dome roof Figs. 5 and 6 proves beyond question on theory the practicability of this type of construction, and offers many new possibilities to engineers in the design of structures hitherto considered impractical.

Acknowledgment

The design of the dome roof was undertaken by the Preload Company of Canada Limited.

THE ENGINEERING INSTITUTE OF CANADA AND RESEARCH*

C. R. YOUNG, M.E.I.C.
Dean of the Faculty of Applied Science and Engineering, University of Toronto

My assignment, as I understand it, is to say something of the attitude of The Engineering Institute of Canada to research in this country. I may say immediately, sir, that that attitude is a most cordial one.

The Institute, which is now nearly sixty years of age —actually 59—adopted in its charter a statement of its attitude to research which called for original investigation in all branches and departments of knowledge which might be associated with the engineering profession. That particular item in the charter has persisted through these sixty years and the Institute stands strongly in support of all useful activities in this field.

The Engineering Institute of Canada is an organization of over 8,000 members, with 28 branches extending from Sydney to Victoria. It is organized, not only for purely technical proceedings having to do with the preparation and reading of papers and the carrying on of discussions, but for the support of any national enterprise which might properly come within the purview of a professional organization. By reason of the fact that the membership is composed of engineers of all kinds and sorts, its activities are extremely diversified.

Its research interest might be said to have been directed to production research and development rather than to scientific research and development. An engineer is a person who takes the discoveries of the pure scientist and puts them to use, and it is in the adapting of these discoveries to the use and convenience of man that the engineer performs his greatest task.

In 1907, on the occasion of the failure of the first Quebec bridge, there developed a demand for the setting up of testing laboratories in Canada which would be able to test structural members and materials of a scale which had not been possible in this country up to that time. The Institute carried on a campaign running from 1909 to 1917 directed towards bringing about this new establishment. There came upon the scene in the last war those who advocated the building of a great research laboratory at Ottawa, and the Institute, feeling that this was a broader and more comprehensive enterprise than merely the establishment of testing laboratories, supported the project warmly. Out of that campaign came, as you know, sir, the National Research Council. The Institute has always supported that Council most warmly.

It formerly was very active in the field of specifications and standards. That is an activity which I presume might reasonably be classified under professional research and so the Institute formulated many specifications. During the last war there was developed the idea of what was then known as the Canadian Engineering Standards Association, which now goes under the new name of the Canadian Standards Association. That Association has carried on very valuable work throughout the years.

Many special activities have come within the field of research interest of the Institute. One is the study of the deterioration of concrete in the West. Those who are concerned with concrete structures there have had a great problem over the years. Back in 1921 the Institute set up a committee on the deterioration of concrete in alkali water areas. Succeeding that committee came the present committee on deterioration of concrete, which is doing useful service in trying to devise ways and means for the production of better concrete and for remedying concrete which may be faulty.

To show that the Institute's interests have been wide and varied, Mr. Chairman, I might cite, as other activities of the Institute, the inquiry into the fuel field in 1923 and 1924. It did not settle the fuel problem in Canada, but I think it outlined the essential factors in that situation.

For some time it has maintained a standing committee on prairie water problems and has formulated a proposal for the conservation of water and its utilization in southern Alberta, a project which has received the sponsorship of the federal government and was granted high priority in the reconstruction programme.

During the war we were greatly interested in civil defence and set up a committee which brought out Professor Webster from London to lecture in this country on civil defence. There are other committees which have just been started, one on quality control and another on community planning, which is another aspect of research.

May I say, Mr. Chairman, that the Institute supports wholeheartedly research in the field of pure science. We realize that the science of today is the engineering of tomorrow. Unless we have new lifeblood from scientific investigation we will not go very far. The engineer is not blind to the tremendous contribution the scientist makes; he realizes his own special role and gives all credit to those who by original discovery of new ideas and principles give him something to which he can bend his own particular talent. It is important to realize that unless we have that constant stimulation from science there will come a stalemate just as there was at the end of the 15th century in Europe. Manufacturers, such as they were, had come to the end of their tether so far as perfecting the methods of manufacturing was concerned. It was not until the 16th century that we began to realize the need for scientific and technical development, such as that now in the making. The Industrial Revolution came as a result of that.

So I say, Mr. Chairman, that The Engineering Institute of Canada is warmly and enthusiastically behind every legitimate activity in the field of scientific research.

*—From an address at the Industrial and Scientific Research Conference held on the occasion of the 75th Annual General Meeting of The Canadian Manufacturers' Association, Toronto, June 4-6, 1946.

THE ONTARIO RESEARCH COMMISSION

Dr. R. C. Wallace, Hon.M.E.I.C.
Chairman, Ontario Research Commission and Principal, Queen's University, Kingston, Ont.

An address given before the Toronto Branch of The Engineering Institute of Canada on February 19th, 1947.

Dr. Wallace describes the functions of the Commission, and explains how it is being aided by the various advisory committees. He tells of the interest in, and support of, the research programme by all levels of the Ontario Government. He outlines what industry is doing for the programme and how industrial research may be co-ordinated with the work of advisory committees and of Universities. Encouragement is being given to students of promise, in an effort to overcome the serious shortage of scientific personnel.

The Ontario Research Commission was established by Order-in-Council of the Government of Ontario on August 28th, 1945, under the Public Enquiries Act, to survey existing research facilities in the province, and to advise as to ways and means by which industrial research might be facilitated. Premier Drew was greatly concerned that the need for research in lessening the cost of existing products and in finding new products should be appreciated everywhere by industry. He was determined that research organizations, whether governmental, university or private, should work in co-ordination, each in their own field, in order that there be no duplication and no gaps in the research front. The personnel of the Commission is representative of private industry, the Ontario Research Foundation, and the universities. Care has been taken that the smaller industries, as well as large scale industry, are represented on the Commission. It was fortunate that Dr. Wilhelm could be secured as secretary of the Commission. His contact with research men both federal and provincial is unusually wide, and his experience and knowledge have been invaluable.

Two principles have guided the Commission in initiating its work. The first is that if research men in any broad field of enquiry can get together to discuss their problems, out of these discussions there will come ideas and proposals. These will be stimulating to further research, and will go far to co-ordinate the research that is at present going on. There will be no need to ask for co-operation on the research front. That comes of itself, when full discussion is possible. The second guiding principle is that industrial life is based mainly on the resources that are available. Research into the resources of the province is the preliminary to industrial research and industrial expansion.

Advisory Committees Tied in with Province's Research Programme

Acting on these two principles, the Commission has set up advisory committees on agriculture, on soils, on forestry, on mines and minerals, on fisheries and wild life. These committees consist of fifteen to twenty members in each committee, drawn from the federal service, the provincial departments, the Ontario Research Foundation, the universities, and industry. The members are all active scientific workers, or are closely identified with scientific research. They meet several times a year, and have executive committees which carry on between meetings. They have already done excellent work in surveying the field, and in making proposals to the Commission for extension of research in important areas not already cultivated.

There is a unanimous feeling that these committees should become a permanent part of the research establishment of the province. They serve to co-ordinate the interests of the men in the universities, whose main concern is fundamental research, with the men in the governmental departments, who are interested in research which will assist in administrative problems, and with the research men in the research foundations and in industry, who are in the field of applied research. This coming together is wholesome, not that it draws a man away from fundamental to applied research, or vice versa, but in that it gives the research worker in any field a better understanding of the relation of fundamental research to the practical problems which have to be met in the province of Ontario.

I do not propose to deal with all the recommendations that have come to the Commission from the advisory committees. Single instances will suffice to serve as illustrations. The committee on fisheries and wildlife stimulates the work at the biological stations. It is working towards an ecological centre which will be the mainspring of research in all biological problems in which the province is interested. The committee on mines and minerals is concerned with the corrosion of wire rope as used for cables, and with the development of electric smelting for iron ores. The committee on soils is concerned with the climatological, the physiographical and the micro bacteriological problems associated with soils in their practical bearing. The committee on forestry has divided into two subcommittees. One deals with research problems in forest growth and forest management. The other develops research on the waste products of the sawmills and the pulp mills. In a similar way the committee on agriculture has organized five subcommittees to deal with various phases of research in the field of agriculture. Here the Commission has had the advantage of discussions with all the departments of the Ontario College of Agriculture, in which a great part of the research in agriculture for the province is being carried on.

Provincial Government's Support Assured

From these advisory committees there have come to the Commission recommendations with reference to expenditures on research which the Commission has dealt with, and, where it seemed advisable, has presented to the Government through Hon. M. Michener, Provincial Secretary, under whose authority the Commission acts. A Committee of the Cabinet has been set up to act with Mr. Michener on financial and other requests in which the Government may be concerned. They are the Provincial Treasurer, the Minister of Mines, the Minister of Lands and Forests, the Minister of Agriculture, the Minister of Planning and

Development. They represent departments with which the Commission has close contacts, and with which problems of policy have from time to time to be worked out.

The Commission has met this Committee of Cabinet, and has discussed with the Committee the situation as they see it and the part that we feel the Government may play, both in financial assistance and otherwise, in the furtherance of research in Ontario. May I be permitted to express my appreciation, and that of my colleagues, at the very active interest in our work on the part of the Government. Our Minister has sat in with us at many long meetings. His judgment and advice have meant much. And the Commission was established as a result of the very lively concern on the part of the Premier that research should play its part in the establishing, the maintaining and the enlarging of markets, export and otherwise, for the products of our Ontario industries. The time is not far distant when the competition will be very severe. Cost and quality will decide. Without new ideas, new knowledge, new methods, the race may well be lost. It is from research that these new ways come.

Industry's Part in Research Programme

Industry may carry on research on its own behalf, or use the results of research as carried on by others. All the larger industries now have their own research establishments, and are doing excellent work. But over 80 per cent of all industry is small—that is, in units of not more than 200 men. It is not feasible in such industries to establish research personnel. Not infrequently the management is not alive to the need for research, nor in touch with the progress of research in his own particular field. Nowhere has it been found easy to apply a technique which will be effective for small industry, but the experience of other countries has given the Commission some basis of policy which is now being recommended to the Government.

The first requirement is information. The manufacturer needs to know what is going on in his field of operation. He needs to know it in a form which is simple and non technical. This necessitates an information service, competently handled and directed to his particular needs. Arrangements are on foot for the setting up of this information service, either directly by the Government, or through the Ontario Research Foundation. This in turn is likely to lead to requests for research on special problems connected with the industry, and to relationships with the Foundation or the National Research Council which these organizations are especially fitted to develop.

There is a further step in this process which has come about fairly successfully in England, but has not as yet met with success in Canada. It is the formation of trade research associations, in which the Government participates with the members of the Association in financing research institutes for that particular trade. It seems to the Commission advisable to explore fully the possibility of such associations in Ontario as the ultimate goal in the developing of research for the benefit of the small and large manufacturer together. It is fully realized that much preliminary work will be necessary before such a step can be contemplated with any hope of success.

Some material steps have been taken. The Canadian Manufacturers' Association have had a panel discussion on industrial research at their annual meeting in 1945 and 1946. These discussions have in each case lasted for two days, and have been well attended by industrialists not only from Ontario, but from all parts of Canada. The papers which have been presented, and the summary of the discussions, have been published in booklets which have had very wide circulation. Considerable interest has been aroused, and the groundwork has been laid for practical developments. The Canadian Manufacturers' Association also endeavoured to find out what the expenditures in research were in Canada by industry, but this led to very inconclusive results as so few manufacturers gave information of value. The Department of Reconstruction in Ottawa has arranged for a field service where the problem of the manufacturer is discussed in person, and such information given and suggestions made as will help him to tie up more clearly to the research institutions. It is still too early to assess the value of this work, but it gives real promise.

Current Expenditures Compared

Notwithstanding the imperfect data, some measure of relative weight of the importance to be placed on research can be illustrated by the figures which are available. The Government of Ontario, through the various administrative departments, spends almost $1,000,000 per year on fundamental and applied research. The Ontario Research Foundation has an annual budget of $350,000 all of which is given to research. The universities in Ontario spent a sum probably exceeding $750,000 in fundamental research in 1944-45, of which over $250,000 was provided by the National Research Council. As three of the universities, Toronto, Queen's and Western obtain funds from the Provincial Treasury, part of this expenditure may be considered to come directly from the treasury of the province. Two hundred and eighty firms in the Dominion (a large proportion in Ontario) reported that they spent in 1944 over $10,000,000 in research, while the National Research Council and the departments of Government in Ottawa spend very considerable sums, which have not been estimated as to provinces, for the carrying on of research directly related to Ontario's resources and industries.

These sums in aggregate may seem considerable, but they are small as compared with what some other countries are doing. It is considered reasonable in industry that two per cent of total value of production should be put into research. None but the very large companies even approximate to this figure, and the smaller companies fall woefully short of any such goal. The United States Government is spending a billion and a half dollars this fiscal year on research and development, a considerable portion of it in the colleges and universities. In Great Britain the Government places so much stress on the fundamental research which the universities carry on, in its bearing on industrial development and the recovery of export markets, that the funds available to the Parliamentary Grant Committee for distribution to the universities has risen from two million to over nine million pounds. It has been predicted by Sir Ernest Simon that as much as twenty-five million pounds will be available in 1955 for purposes of the universities. Britain is not now a wealthy country. She has to husband her resources. The figures quoted above are an indication of the weight which the British place on the necessity for fundamental research on which all applied research must be based.

Supply of Trained Personnel a Limitation

One of the problems which the war has bequeathed to us is rooted in the dearth of trained scientific personnel. Young men and women were drawn into war forces or war services before they had had time to be given training in research. It is of first importance that personnel be made available for the needs that now have to be met. In the biological field, for example, where programmes of considerable magnitude are calling for action, there is a very grave lack of young workers with enough experience to give valuable assistance. The Commission, at the instance of the Minister, has established fellowships in order to attract able students, and already is finding men and women of promise who will become in a few years capable research workers in those fields in which research workers are greatly needed. This is an expenditure of funds which will give valuable returns.

This is not a continuing Commission. Its function is to advise the Government as to the best method of encouraging research for industry, and not for the time being alone, but on a permanent basis. A preliminary report is now in the hands of the Government, and a final report will be submitted at the end of this year. It will be our responsibility to see to it that a method of procedure is recommended that will make it possible and easy to carry forward into the future some of the most profitable undertakings which have been set on foot by the Commission. If that can be achieved, the Commission will have served its purpose.

THE DIRECT OPERATING COSTS OF TRANSPORT AIRCRAFT

(Continued from page 210)

also be increased. Initial cost and maintenance costs will be higher for such an aircraft. Making reasonable allowances for the effect of these factors on the block speed, operating costs and payload, the data plotted in Fig. 13 shows the influence of such increases in cruising speed, derived from increasing altitude at constant cruising power, on the operating economics of aircraft No. 8 at a utilization of 2000 hours per annum, over block distances of 300 and 750 miles. The longer block distance has been included because the advantages of high altitude cruising are more likely to be realized on long-range operations than in short-range services.

The fourth method of increasing cruising speed is by installing engines of greater power. This necessitates an increase in gross weight to carry the same disposable load and an increase in structural strength and weight consequent from considerations of load factors at increased speed. This means of increasing speed has been treated by Mentzer and Nourse in Reference 11 and their method has been adopted here in calculating the resultant operating costs for aircraft No. 8 over a 300-mile block distance, as shown in Fig. 14.

Figure 13 shows that the effect of increasing cruising speed by using higher altitudes is somewhat more marked over block distances of 750 miles than over a 300-mile distance, although from the economic viewpoint operation over 300 miles is preferable, regardless of cruising speed. In order to gain a cruising speed of 230 mi. per hr. at the same cruising power as used at lower altitudes (10,000 ft.), ascent to 37,400 ft. is necessary.

Figure 14 shows that costs per mile and costs per ton-mile both increase as a result of installing larger and more powerful engines. However, from the revenue less cost per hour flown curve it is evident that the overall economy does not suffer until the cruising speed is raised above 220 mi. per hr. by this means.

The costs given in this paper were applicable to operating conditions during the early part of 1946. Rising costs since that time should be taken into account in any application of the formulae given herein.

Acknowledgments

The authors wish to acknowledge the kind co-operation of the Civil Aeronautics Board in providing figures relative to airline consumption of gasoline in the United States. They are also indebted to Trans-Canada Air Lines, who furnished them with considerable information concerning airline operations in Canada.

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THE I.L.O. BRUSSELS CONFERENCE

J. N. FLOOD, M.E.I.C.
President and Manager, John Flood & Sons Limited, Engineers and Contractors, Saint John, N.B.

A condensed summary of Canadian Delegate's report to the Canadian Construction Association

This condensed redraft of the Canadian Delegate's report on the conference was prepared by Mr. Flood specially for publication in the Journal. In it he describes the work of the conference and outlines the statement of policy presented by the employer group. The implications of the conference and its importance as part of a world wide movement are discussed, and the importance of employer participation is shown. Every practising engineer and particularly those concerned with labour-management relations, should study it.

The conference was held at Brussels, Belgium, November 25th to December 3rd, 1946, and was the initial meeting of the International Labour Organization Industrial Committee on Building, Civil Engineering and Public Works. Nineteen nations were invited to this initial meeting, namely: U.S.A., Australia, Belgium, Brazil, Canada, Chile, China, Czechoslovakia, Denmark, Finland, France, United Kingdom, India, Netherlands, Sweden, Switzerland, South Africa, Italy and Mexico. The last two did not send representatives. The committee was tripartite, with each member nation being entitled to send six representatives; two employers, two workers, and two government delegates. In addition to the six official representatives each was entitled to have non voting technical advisers. Most nations, but not all, sent the full quota of delegates. The total number attending was about 135. The writer was one of the two employer representatives from Canada, both of whom were nominated by the Canadian Construction Association, the other employer representative being J. Clark Reilly of Mansonville, Que.

The conference proceedings were held in the Palais du Brabant, and were carried on in two official languages, English and French. Our impression of the delegates was that the labour group and the employer group were well represented by qualified men, but that the government representatives were not selected with regard to their knowledge of the problems of the construction industry, and were therefore not in a position to participate as fully as they might have done. This point should receive attention if the I.L.O. is to be of value in charting the course we are to follow.

To expedite the handling of the agenda the conference resolved itself into three committees, designated as follows: (1) sub-committee on general problems relating to production and reconstruction, (2) sub-committee on general conditions of work, and (3) sub-committee on Industrial Relations. In addition to these committees both the employer group and the labour group met in daily caucus to consider conference topics as they might affect their particular interests.

Policy Stated By Employer Group

At the opening session the employer representatives submitted a brief. In this brief they enunciated the principles which they felt most apt to produce the desired result of increasing the world's supply of fixed structures. These principles were in the form of nine statements of policy which may be very briefly summarized as follows:

1st. Our belief in the private enterprise system as opposed to state control and operation.

2nd. That management should be free to exercise its function to manage.

3rd. That sanctity of contract is essential to satisfactory industrial relations.

4th. Our belief in the principle of social security.

5th. The need for adoption of the most modern technique in the production of buildings.

6th. Our belief that freedom of world trade, coupled with lowered costs and higher standards of living, are the most effective means of promoting and maintaining industrial peace.

7th. Our belief that a high level of employment, at satisfactory and economic wage levels, can be maintained only by a high level of production.

8th. That steps should be taken to increase the number of skilled craftsmen in the industry by apprenticeship training and also by training in approved technical establishments.

9th. That the industry's responsibility to the community is a dual one, shared by both employers and employees, and can be discharged best by increasing the over-all efficiency of the industry.

While these nine points of basic policy were opposed in principle by some of the labour representatives, there can be no argument about the fact that they did exert an influence on the trend of the conference, and furnished evidence of the good intent of the employers with respect to some of the reasonable aspirations of labour.

Work Divided Up Between Three Committees

The results of the conference were contained in a series of resolutions. These were presented by each of the three committees, and were adopted by the plenary session in the closing days. Some of the topics dealt with in the resolutions are as follows:

Committee No. 1:—Stabilization of employment by long term works programmes, methods of increasing productivity, standardization of building components and practices, advance planning, steps to overcome building material shortages, controls in relation to urgency of work, recruitment and training of workers, movement of manpower as between countries, emergency accelerated training of workers, compilation of statistics, and research.

Committee No. 2:—Construction hazards; job sanitary measures and industrial hygiene; social security covering industrial diseases, accidents, unemployment, sickness, disability and old age; working hours; seasonal change in work day (longer in summer than winter); forty hour week; holidays with pay; relationship of unemployment to over supply of workers; stabilization of employment and earnings; and rural housing.

Committee No. 3:—Rights of employers and employees to safeguard their collective interests; public welfare in relation to industrial disputes; industrial peace in relation to production; sanctity of contract;

negotiation, mediation, arbitration; jurisdictional disputes; work stoppages; management-worker cooperation; freedom of association; recognition of trade unions as bargaining agents; worker participation in safety, health and welfare measures; living standards of workers; and national joint committees to explore the economic problem touched upon by conference.

All three committees requested I.L.O. to prepare studies and collect data on specific matters for the information of future conferences. This material will give the next meeting of the committee a background of information, the lack of which was in part responsible for the failure of this meeting to deal more fully with certain matters. This lack nevertheless may not have been without its advantages. One of the greatest dangers in such a movement may be too much haste. Some of our labour friends are prone to ignore the need for caution and would accelerate the process of change, without due consideration of the inherent dangers.

Importance of Employer Participation

This initial conference of the Building, Civil Engineering and Public Works Committee of the I.L.O. could hardly have been expected to say the final word in drawing up a programme to cover such a vast aggregation of diversified interests. It unquestionably did lay the foundation, and set up some of the framework around which future conferences may build the structure, stone by stone.

The writer, being an employer delegate, makes no apology for the fact that his observation and viewpoint are those of the employer. The reaction of many of the worker delegates would naturally be quite different to his, and it was no surprise that many of these worker delegates evinced no friendliness toward private enterprise. As employers, we might well ask ourselves if we are wise in participating in these international conferences. Well, in the first place, the conferences will unquestionably go on, even if we withdraw. In the second place, the symptoms of a world condition which are manifest at such a conference are not caused by the I.L.O. Our withdrawal would not mend these conditions. Being inside the organization gives us the opportunity to oppose developments we may not like. Remaining aloof would deprive us of this opportunity to influence world opinion and trends.

I.L.O. Conferences Part of a World Wide Movement

The Brussels conference furnishes ample evidence that definite forces are on the march, and that these forces are bound to influence our economy. We cannot play ostrich and hope to remain untouched by the economic reforms that are taking place in other countries. There is also evidence that individuals, groups and nations are tending toward the belief that our progress must be regulated by planning. If this be so, then the nature of the planning will be determined, or at least influenced, by the decisions of just such conferences as this one. This gives us the key to the place these conferences should have in our national thinking.

Sitting in on such a conference one experiences something of a shock at the scope and significance of the movement of which this conference is but a part. This may be due in some measure to the obvious fact that the most radical and the most irresponsible elements are sometimes the most vocal. There is also the ever present difficulty of finding a common denominator for the economic anomalies of a group of nations whose problems differ as widely as do those of say India and the U.S.A. The findings of any committee within such a conference are necessarily a compromise between extremes.

Frankly, our Canadian delegates assess the I.L.O. as an organization dedicated to the cause of elevating the status of the workers of the member nations. There is one school of thought in evidence which would do the elevating at any cost, even if it involves the sacrificing of everyone and everything not " Labour ". But there is also some evidence of a more tempered viewpoint, and signs that management is being welcomed for the definite purpose of lessening the increasingly apparent danger of economic disintegration inherent in the process of change. Management's participation now may perhaps assure that, when the millennium comes, there will be something better than steerage accommodation for the survivors.

Changes Must Be Gradual

We, as employers, did not let pass the opportunity of pointing out the significant fact that real wages and standards of living are higher in those countries where private enterprise flourishes. Under-the-surface, but nevertheless significant incidents during the conference indicate this point has not been altogether overlooked by some of the more level-headed leaders of labour. We suspect some of the snipers had their tongue in their cheek, and were more hopeful of impressing their followers at home than their conference associates on occasions when they were loudest in their denunciation of private enterprise.

Whether or not this analysis is the right one, it remains a fact that our participation in these conferences is our opportunity. It gives us a chance to do what we can to ensure that the process of change shall be wisely controlled, to the extent that this is possible. It is to be expected that changes, and great changes too, are inevitable. The objective to strive for is that they may be controlled and directed so as to produce a minimum of dislocation to our economy. The I.L.O., in setting up these Industrial Committees, may have just this in mind. In any case, it is the writer's view, as an employer, that we should continue to participate, and to arrange that the views of our industry are formulated and presented to future conferences by our representatives. This was not possible at this initial conference, but will be of increasing importance as the committee develops and expands its work.

In conclusion it may be said that to have participated in a conference of this nature cannot be other than a broadening experience, affording as it does an opportunity to see the development and unfolding of a movement which is destined undoubtedly to have a profound effect upon management-labour relations in our industry; indeed upon our whole economy. We may not like and agree with all that transpires, but it is better to be a party to it than to remain outside the movement and allow these trends to develop unchecked in a manner we may not like.

From Month to Month

News of the Institute and other Societies, Comments and Correspondence, Elections and Transfers

CIVIL SERVICE SURVEY

Recently the Classification and Salary Committee of the Professional Institute of the Civil Service circulated a questionnaire to their members in order to ascertain how far the recent salary increases following the Gross Inequality and Gross Injustice Order, had permeated their organization.

There are 1880 members of the Professional Institute. Only 941 returned the questionnaire, which again demonstrates how difficult it is to get people to complete a ballot or other form, even when the purpose is to secure more salary for them. It is discouraging to committees to see such small returns for their labours—so little appreciation of their efforts.

The results of the survey show that 73 per cent had received increases ranging from $60 to $1,500 per year, with an average of $256 per year. In the light of the ridiculously low scale previously in force, these figures are not impressive. A further disturbing factor is that the fixed and short range of salary in each bracket will mean that before long most people will be at the top of their schedule, and with no opening ahead will have to stand at that figure until they stagnate or find better rewards elsewhere.

The inadequacy of the recent improvement is shown by the fact that of those reporting 76 per cent expressed dissatisfaction with their classification.

For some time nothing has been heard of the Royal Commission report. As a result of their recommendations several top officials had their salaries raised—with which nobody will disagree—but it would be nice if the little man could get into the slightly changing pictures to a greater extent.

Everyone seems interested in the plight of the professional worker except the Treasury Board, and without their interest all else is in vain. There must be some way of moving that obstruction, but no one has found it as yet.

PARLIAMENT HEARS ABOUT LOW SALARIES

Speaking in the House of Commons on March 7th, 1947, in the debate on the Speech from the Throne, Monsieur Maurice Bourget, M.E.I.C., member from Levis, brought to parliament's attention the importance to the nation of scientists and engineers, and pleaded for better recognition of the service they render. Monsieur Bourget, in making these remarks, has done a valuable service to the profession, and for the benefit of the membership his address is quoted here in part:

" Since I am dealing with labour, I believe it is my duty to draw the attention of the house to a section of our population which is performing essential services in the economy of our country, even if this section is not great in numbers. I refer to scientists, architects and engineers. Since I am a professional engineer, I may be in a better position than many of our people to understand the role played by the members of these professions before and during the last war, and the great task which they will be called upon to fulfil in the future. But for the information of hon. members and for the public in general, may I quote an extract from an article which appeared in the *Institute Journal* of December, 1945, and which is entitled, "Scientists in Government Service ", by C. R. Twinn:

' The British and United States governments have publicly expressed their comprehension of the tremendous importance of science in the modern world. In a white paper dealing with the scientific civil service presented to parliament in September, 1945, by the chancellor of the exchequer appeared the statement:

' The governments are deeply conscious of the contribution made by scientists toward the winning of the war. They are equally conscious of the contribution which science can make during peace to the efficiency of production, to higher standards of living, to improved health and the means of defence.'

" In November, 1944 the President of the United States, impressed with the importance of scientific research in the national life and concerned with its continuing future in that country, requested Doctor Vannevar Bush, director of the office of scientific research and development, to make recommendations on a number of points related thereto. Doctor Bush, in reporting to the President in July, 1945, had this to say:

' Without scientific progress no amount of achievement in other directions can insure our health, prosperity and security as a nation in the modern world.'

" Nobody can deny that men who merit such magnificent praise are at least entitled to recognition from their respective governments of the service which they render to society."

Monsieur Bourget then referred the House to a recent editorial in *The Engineering Journal* which drew attention to a number of cases, taken at random, of grossly inadequate salaries paid in the federal Civil Service; a Bachelor of Science from British Columbia who is an M.A. of McGill receiving $3,180 after 19 years experience; another M.A. with four years experience and an $1,800 salary; a Manitoba graduate with M.Sc. from Cornell, who gets $1,620 after three years service; an Arts graduate of McGill, with M.A. from Wisconsin and D.Sc. from Edinburgh, drawing $3,180 after fifteen years.

Quoting from a number of recent Civil Service application notices for engineers and architects, offering salaries too low to attract applicants, Monsieur Bourget continued:

". . . Is it surprising that governments are having difficulty in retaining valued employees after they have worked under these unsatisfactory conditions for a few years? Will our governments not realize that they will lose employees whom it will be impossible to replace, and that such loss will cripple the public services of which we should be so proud? I hope that, since war-time restrictions are abolished, the Minister of Finance (Mr. Abbott) and the treasury board will do their best to remedy these wrongs.

May I ask fair-minded members of this house to support me on this issue. I should like the public at large and the federal and provincial governments to recognize that those whom Doctor Samuel Smiles rightly called ' the makers of modern civilization ' are entitled to a salary commensurate with the great services they are rendering."

Following are copies of a subsequent exchange of correspondence on the subject, between the General Secretary of the Institute, the Prime Minister and the Secretary of State:

March 13, 1947.

Right Honourable W. L. Mackenzie King,
Prime Minister of Canada,
House of Commons,
Ottawa, Ont.

Sir:

On Friday, March 7th, a member of your Government, Maurice Bourget, spoke in the House of Commons about the salaries paid by the Federal Government to its professional employees. In this talk Mr. Bourget pointed out the evils of the present policy.

The Engineering Institute of Canada supports Mr. Bourget in every detail of his address. For years we have been presenting these arguments to members of the government and to the Civil Service Commission, and we have been giving considerable publicity to the subject through the columns of our monthly publication, *The Engineering Journal.*

Engineers everywhere will be delighted to know that Mr. Bourget has brought this subject so fairly and so fully before the House, and I am sure his address has been well and favourably received right across Canada, even outside the professional circles.

We sincerely hope that the facts presented by Mr. Bourget will lead to some remedial action on the part of your government.

Yours sincerely,
L. Austin Wright,
General Secretary.

OFFICE OF THE PRIME MINISTER
CANADA

Ottawa, March 17, 1947.

L. Austin Wright, Esq., M.E.I.C.,
Etc.

Dear Sir:

The Prime Minister has asked me to acknowledge your letter of the 13th of March, written on behalf of The Engineering Institute of Canada, concerning professional personnel employed in the Civil Service of Canada.

At Mr. King's direction the representations of your letter are being brought to the attention of the Secretary of State.

Yours sincerely,
(Signed) G. J. Matte,
Private Secretary.

THE SECRETARY OF STATE OF CANADA

Ottawa, March 18, 1947.

L. Austin Wright, Esq., M.E.I.C.,
Etc.

Dear Mr. Wright:

My Minister has asked me to acknowledge your letter of March 13th, addressed to the Right Honourable the Prime Minister, and referred to this office attention.

My Minister wishes me to assure you that Mr. Bourget's observations and your representations will be given the most thorough and sympathetic consideration.

Yours truly,
(Signed) W. O. Davis,
Private Secretary.

MORE ON FUTURE OPPORTUNITIES

The following report issued by the Bureau of Technical Personnel, is based on a survey of employment opportunities for professionally trained persons. The survey covers over one-half of the total employment field numerically, but much more than half of the employers likely to require new graduates.

These figures, coupled with the report from the Engineers' Joint Council on page 176 of the April *Journal,* fill in a large portion of the picture of prospective employment, and definitely supply new information for Canadians.

MEMORANDUM BASED ON FURTHER ACTIVITIES RELATING TO THE SURVEY OF CANADIAN REQUIREMENTS FOR PROFESSIONALLY TRAINED PERSONS

(With particular reference to Engineering)

1. *1919-1944*

Dominion Bureau of Statistics ("Supply and Demand in the Professions")—1945

Approximate population 25 years ago	9,000,000
Approximate population now	12,000,000
Increase	33 1/3%
Average graduating class in engineering 25 years ago	400
Average *normal* class now	800
Increase	100%

Assuming fixed long-term average of percentage absorbed, there is every indication of a marked increase in numbers of opportunities in proportion to population over the period considered.

2. *1939-1946*

Employment in Canada as reported by employers in industries other than Agriculture, from "The Employment Situation at the beginning of January, 1947".

1939 Index (1926—100)	120
1946 Index (1926—100)	180
Increase	50%
Estimated number of engineers in Canada 1939	18,500
Estimated number of engineers in Canada 1946	24,000
Increase	30%

3. *1947-1951*

Number of engineering graduates expected in 5-year period by latest estimate of universities	13,000
Deduct allowance for emigration and for diversion to non-engineering fields	1,500
Number available for engineering openings in Canada	11,500
Numbers of openings forecast by employers covered by survey	8,000
Remainder	3,500

The employers covered by the survey represent about one-half of the total employment field numerically, but considerably more than one-half of those industrial and other types of activity most likely to absorb new graduates. A complete coverage of all employers could not, therefore, be expected to yield a further 8,000 openings, but will likely account for the additional 3,500 or a substantial portion thereof.

An analysis of this aspect of the survey has now been initiated.

There are several factors which appear to have a bearing on the question of why it may be possible to absorb engineering graduates at roughly three times the normal rate.

Reference has already been made to the fact that the numbers employed in industry have increased 50 per cent over 1939 while the number of engineers increased only about 30 per cent in the same period. This raises the question whether industry is likely to function with a smaller ratio of engineers to total employees than has applied in the past.

Both the Bureau's experience and the opinions of employers suggest that the trend is rather towards a freer use of graduate engineers.

Some concern was expressed prior to demobilization that the release of thousands of engineers from the armed forces and war production would result in a substantial unemployable surplus. Actually all such engineers were rapidly absorbed in peacetime operations as were the new graduates who became available in the meantime. Furthermore, except for one short period late in 1945, when "resettlement" was at its peak, there has been a marked shortage of engineers to fill listed openings.

In this connection it might be mentioned that, while the proportion of veterans generally who qualified for out of work benefits was about 1 in 20, the proportion among veterans who were engineers was something of the order of 1 in 2,000.

In the course of the current survey employers have been asked if, in their opinion, there is any trend towards freer use of university-trained personnel. The last compilation shows that, out of 1,334 employers interviewed, 1,005 gave an answer to this question. Of these, 850 answered yes. These 850 employers have approximately 650,000 persons on their payrolls including 16,807 with university training. The 155 employers who did not feel there was any such trend employ about 100,000 persons of whom 2,671 have university training.

Just a word might be said about numbers in the different branches of engineering. Some caution must be used in dealing with the figures gathered in the survey to date. Extent of coverage varies.

It is pretty safe to say, however, that over the next five years the greatest demand will be for civils followed closely by mechanicals and electricals. Chemical engineering and mining show somewhat smaller proportions of the whole, and the balance is composed of a number of still smaller groups.

FEDERATION OF EMPLOYEE-PROFESSIONAL ENGINEERS OF ONTARIO PRESENT VIEWS

In the following letter the president of The Federation of Employee-Professional Engineers and Assistants of Ontario takes the *Journal* to task for an editorial appearing in the February issue. The information printed in that editorial was received from very reliable sources, which sources still maintain that the information is correct. Nevertheless, the *Journal* is pleased to reproduce Mr. Barnes's letter so that both sides of the case may be presented.

In the fourth paragraph of his letter Mr. Barnes refers to the *Journal* statement that the Board was certifying groups of engineers that included many non-professional types as well, the whole being employees of the same department. The letter goes on to say "There has been no case where the Labour Boards have insisted on the inclusion of such groups of persons in the bargaining unit". Our information is that in the Bell Telephone group the non-professional employees in the department doing work of an engineering nature had to be included before the certification was authorized. Further inquiry reveals that this *is* the case and what is more, the non-professional outnumber the professional.

In a later paragraph Mr. Barnes refers to the developments in the province of Quebec, and suggests that the brief recently presented by the Quebec Corporation to the Minister of Labour "was prepared in a Council composed almost if not entirely of men in the management class". The fact is that in the Corporation the majority of the membership is in the management class, and this group gave strong support to the proposal that collective bargaining for engineers by engineers should be supported by the Corporation.

The same thing is true in the membership of the Institute. The questionnaire circulated by the Institute's committee showed that uniform support for collective bargaining came from the senior members, most of whom were in the management class. In the light of these facts, it does not seem fair to imply that the senior engineers are opposed to collective bargaining. The facts do not bear out such conclusions.

If collective bargaining is desirable for engineers, then it is most certainly desirable that it should be controlled by the profession itself. The editorial in the *Journal* was intended to indicate that bargaining was not now within the control of the engineers, or that at least the present set-up was such that this control might readily pass into the hands of others—perhaps the trade unions.

Herewith is the letter:

Toronto, Ont.,
April 8th, 1947

Editor,
The Engineering Journal,
Montreal, Que.

Dear Sir:

In *The Engineering Journal,* February 1947, there appears an article under the heading of "New Labour Legislation". Certain statements are made in this article, particularly those referring to the Ontario Federation activities, which are not, in fact, correct. We request, therefore, that you publish the facts as outlined in this letter in the next issue of *The Engineering Journal*, and give them the same prominence as the article referred to.

Regardless of the intentions of the framers of the Labour Legislation known as P.C. 1003, the Labour Boards (Wartime Labour Relations Board, National, and the Ontario Labour Relations Board) have recognized the right of employee engineers and scientists to organize themselves into groups or units for the purpose of collective bargaining with their employers. In many cases, this action has allowed engineers to bargain for themselves, through bargaining representatives of their own choice, instead of being forced to bargain through an agency representing a large group of employees from the office boy up. In such a union, a professional group would find (and has, in fact, found) itself a small minority, being represented by agents who know nothing of the classification of professional positions or their value to the employers. The professional engineers in Ontario, in response to a questionnaire, indicated by a large majority that they preferred to be " bargained for " by engineers of their own choice.

It is true that Labour Boards have taken the position, in granting certifications, that the unit must be a functional group to be appropriate for collective bargaining; i.e., they will not certify a group of engineers simply because they are members of a Professional Engineering Association, but will certify, as an appropriate group for collective bargaining, persons who are performing professional engineering services. If persons who are not registered with the Provincial Association are doing engineering work contrary to the law of the province, the Labour Boards leave it to the Professional Association to enforce the law through the powers given to them under their Act.

You give as an example of the way the Boards are acting the following: " In the engineering department of an employer, the agency would have to accept representation for draughtsmen, tracers, blue-printers, stenographers and so on, as well as for engineers." In the fourteen units which have applied or are presently applying for certification through the Ontario Federation, there has been no case where the Labour Boards have insisted on the inclusion of such groups of persons in the bargaining unit. In one or two cases, a few draughtsmen requested the bargaining agents of the Federation unit involved to act for them, and it agreed because of the peculiar circumstances of the cases and the fact that the persons added constituted only a very small minority. They have not been admitted to membership in the Federation or in the Federation Branch or Unit.

In another paragraph, you state that " the Ontario Federation declined to accept the bargaining certification granted by a Board—although they had applied for it—because the Board insisted they include the non-professionals as well." This is indeed news to us, because such a certification has never been granted or refused.

Reference is made to the brief submitted by the Council of the Quebec Corporation of Professional Engineers to the Labour Minister, reversing its stand on collective bargaining for engineers and scientists. You do not say that this brief was prepared in a council composed almost if not entirely of men in the management class, without any directive from the members of the Corporation at large. In spite of the fact that Quebec Legislation does not encourage collective bargaining organization in purely provincial cases, the Quebec Federation obtained certification for two groups of engineers and scientists, which were inter-provincial in nature, before the Wartime Labour Relations Board (National). It is obvious that the reason why the Quebec Federation has not obtained more certifications (and more members) is because they are limited in their scope to groups outside the provincial jurisdiction.

You mention that the brief of the Corporation of Professional Engineers to the Labour Minister refers to the decreasing membership of the Federations. The inference is that membership in the Ontario Federation is decreasing, which is not a fact. We have more members in good standing today than at any time since the Federation was started in 1944. The Professional Societies and Associations have been attempting for the last twenty-five years to better the financial and professional status of the engineer and scientist and have achieved gratifying success. We are convinced, however, that, since the Federation was formed, more success has been obtained in securing a better financial status and recognition of the value of the services of employee engineers than ever before.

The cooperation of all professional, technical and scientific groups can do much to achieve the results for which we are all striving.

(Signed) F. C. Barnes,

President,
The Federation of Employee-Professional Engineers and Assistants of Ontario.

CHEMICAL INSTITUTE TO HOLD ANNUAL MEETING

Announcement is made that the Chemical Institute of Canada will be holding its 1947 meeting at the Banff Springs Hotel at Banff, Alta., on June 8th, 9th, 10th and 11th.

Special features of the programme will be a discussion on atomic energy in relationship to the Chalk River plant; a talk on the social responsibilities of science; and on the economic and professional status of engineers and scientists.

One morning will be devoted to a symposium on the resources of western Canada.

An outstanding feature will be an exhibition that will illustrate recent developments in the chemical industry. Many firms and individuals promise to participate in it.

The Institute announces that all sessions will be open providing the participants are registered. In addition to the professional and social programmes, a post-conference tour has been arranged, which would take parties to the oil refineries, chemical plants; the huge development at Trail; ending up with a visit to Vancouver on the Pacific Coast. Special trains to cover this feature have been arranged.

Heavy advance registration indicates that the conference will be well attended, therefore, persons who are considering the meeting should make early reservations both at the hotel and with the transportation companies.

The conference office is at 818 19th Ave., West, Calgary, Alta.

CANADIAN ASSOCIATION OF PROFESSIONAL PHYSICISTS

The Association will hold its Second Annual Congress at the University of Western Ontario, London, Ontario, from June 12th to 14th. The afternoon of Thursday, June 12th, is to be devoted to papers and a discussion on " Physics in Industry ". This should be of especial interest to engineers as well as physicists. Friday, June 13th, will be devoted to symposium sessions on " Nuclear and Atomic Physics ", and " Geophysics ".

The C.A.P.P. was organized in 1945, to fill the badly needed function of a national society devoted to the interests of Physics in Canada. It is a member society of the Canadian Council of Professional Engineers and Scientists.

THE CANADIAN MUTUAL AID BOARD

A Resume of the Board's Final Report to Parliament

The purpose of Mutual Aid was to make available the products of Canadian war industry to the United Nations in such a manner as to contribute most effectively to winning the war. Due to the policy of Mutual Aid and Lend-Lease, the United Nations have been able to enter upon the postwar period free from the strangling burden of international war debts which, in the twenties, did so much to prevent recovery.

How the Board Functioned

From its inception, the Board's policy was to avoid as far as possible setting up new governmental machinery, so that only a relatively small administrative staff was required. Administrative expenses amounted to only 0.03 per cent of the total expenditures made by the Board.

Formal applications for aid were made in the first instance to the Department of External Affairs, where they were considered from the viewpoint of Canada's international policy. The programmes were next submitted to the Board for consideration and decision, and then forwarded in the form of a requisition to the several procurement departments. These departments placed contracts and arranged shipments. To facilitate orderly disposition of the work involved in consultation with United States authorities, a Washington Advisory Committee was established.

Military supplies produced in Canada, and in short supply, were assigned monthly by the Munitions Assignment Committee to armed services and allied claimants on basis of strategic need. A Committee in London functioned similarly respecting British, Indian and Dominion requirements from British production, while in Washington the Munitions Assignment Board under combined Chiefs of Staff, dealt with American, British and other needs from total supplies.

A Joint War Aid Committee of the United States and Canada was also set up to study problems arising from operations of Mutual Aid and Lend-Lease. Canada was represented on this Committee by members of the Washington Advisory Committee. An Inter-departmental Committee on Mutual Aid was also established in Ottawa with representatives from External Affairs, National Defence, Finance, Munitions and Supply, Agriculture, Fisheries, Trade and Commerce and the W.P.T.B. The Board's Director of Administration was Chairman.

Mutual Aid to Britain

Before Mutual Aid was inaugurated, British and Sterling Area requirements in Canada, which could not be met out of current receipts, were dealt with by four special financial measures. The first of these was the repatriation of Canadian Government and C.N.R. securities held by residents of Britain, amounting to some $700 millions. The second was a loan early in 1942, of $700 millions made under the authority of the War Appropriation Act (U.K. financing). The third was of a more complicated character. In early stages of the war, the United Kingdom had joined with Canada in paying the costs of building special plants in Canada to produce war supplies. In 1943 Canada undertook to repay the United Kingdom what she had spent for this purpose, so funds could be used to purchase munitions rather than for capital equipment. The result was that slightly more than $200 millions was placed at the disposal of the United Kingdom, and plant ownership was vested in the Dominion Government. The fourth measure was a contribution of $1,000 millions to the United Kingdom to purchase foodstuffs and war supplies in Canada. This money was provided under the U.K. War Appropriation Act of 1942. The total made available under these four measures was approximately $2,700 millions.

Aid to Other Nations

Prior to Mutual Aid, Canada provided a credit of $10 millions to Russia to purchase Canadian wheat and flour, two contributions of $77 millions each to UNRRA and shipped a gift of wheat to Greece valued at $19 millions. While Allied Armies were administering occupied areas, Canada also spent $85 millions for supplies purchased in Canada.

The provision of supplies as Mutual Aid ceased on September 1st, 1945. At a later stage, Canada made available to various allied governments substantial long term credits under the provisions of Part II of the Export Credits Insurance Act.

Summary and Distribution of Mutual Aid Expenditures

Funds expended by the Mutual Aid Board up to March 3rd, 1946, totalled $3,975,132,153, of which UNRRA received $1 million, payments for military relief totalled $84,661,968, cash for U.K. purchases in Canada totalled $1,407,031,906 and Mutual Aid totalled $2,482,438,277.

A breakdown of the Mutual Aid shipments to various countries, amounting approximately to $2,484,438,000 was as follows: United Kingdom $2,112 millions, Russia $167 millions, China $40 millions, France $25 millions, New Zealand $15 millions, India, West Indies and Greece $20 millions, and UNRRA $11 millions.

Of Canada's total production for war, valued at $4,921 millions, a total value of $2,797 millions was produced for Mutual Aid countries, broken down as follows, in millions of dollars: Shipbuilding $303, Aircraft $342, Transportation Equipment $843, Ordnance $217, Ammunition Chemicals and Explosives $574, Instruments and Signals $173, General Stores $184, Freight and Inspection $161. The total represented 57 per cent of Canada's total war production.

The cost of the supplies procured for the Board by the various government departments concerned was: Munitions and Supply $2,797 millions, Agriculture $501.2 millions, Trade and Commerce $496.5 millions, Fisheries $38.6 millions.

Winding Up of Board's Activities After VE Day

Immediately after VE Day, commitments were reviewed with representatives of all countries concerned and military programmes were revised and readjusted to meet the needs of the Pacific campaign. When the war ended, all outstanding contracts were reviewed and arrangements made to continue production and delivery of supplies only when an agreement had been reached regarding payment. These supplies were chiefly industrial equipment and foodstuffs. Unshipped Mutual Aid stores were inventoried, and it was found that Canada's own armed services needed some of these stores. The rest were declared surplus to the Crown Assets Allocations Committee.

The United Kingdom, the United States and Canada later undertook to finance procurement of foodstuffs and other supplies for military relief in Europe. The total value of supplies and services so provided was approximately $1,725 millions of which Canada's share was approximately $95 millions, including supplies under Mutual Aid to the United Kingdom and diverted to military relief.

Mutual Aid Advertised Canadian Products

Supplies shipped as Mutual Aid went to all theatres of war, and these as well as UNRRA shipments were identified by the Mutual Aid Seal. The quality of Canadian workmanship has thus been identified all over the world. Many countries previously unaware of the high standards of Canadian industry have made enquiries regarding the peacetime supply of goods made in Canada.

SOUTH AFRICAN LETTER

On 18th February I received a letter from you in reply to my first South African Newsletter in which it was indicated that further contributions of this kind might be of some interest to the readers of the *Journal*. It was apparently considered by you that some information on the vital statistics of the country, with particular reference to engineering activities therein, would be of some general interest. I have, accordingly, endeavoured in this rather statistical newsletter to give some of the basic data on the history, population and general economic structure of the Union which might well act as a background to any further contributions that I am able to make. The author would welcome comments, suggestions and questions from any readers of the *Journal* as it is very difficult, in compiling a newsletter of this kind, to determine which subjects should be covered in detail and which should only be touched upon generally. In giving the following more or less statistical information it should be appreciated that, because of the intervening war period, many of these figures are not as accurate as they might be. This particularly refers to the figures of population which were published in 1936 and have not since been revised.

The Union of South Africa was formed in 1910 by a Union of the Provinces of the Cape of Good Hope, Natal, the Orange Free State and the Transvaal. The adjoining British territories of Basutoland, Swaziland and the Bechuanaland Protectorate are administered by the Colonial Office and the Union Government has no political or administrative control over them although they form an integral part of the economy of the Union, providing large numbers of natives for work in the mines and industries.

It is generally conceded that the gold-mining industry dominates the economy of the Union. The gold industry provides one-fifth of the Union's net income, two-fifths of Government Revenue and seven-tenths of the country's exports. As well there are the basic industries of diamond and coal-mining and agriculture, although the products of the latter are nearly all consumed internally with the exception of sugar cane, citrus fruits, wool and hides etc. During and since the last war secondary industry has made large strides in the Union. Previously this country was almost entirely dependent on imports for all manufactured goods but, when the shortage of shipping cut off this supply, many factories were established in the Union and many overseas companies are establishing branches in the Union and starting to invest capital in this country where the Excess Profits Tax has just been removed in the last Budget and direct taxation is comparatively low. In 1938-39 44.2 per cent of the raw materials used in manufacture were imported and this figure is still high, although more of the Union's natural resources are being developed as time goes on.

Most of the secondary industries are centred in or near the main centres of the Union. Johannesburg is the main centre of industry in the Union, surrounded as it is by the towns and mines of the Reef which contain, with Johannesburg, by far the largest section of the population of the Union as will be shown later. Cape Town comes second with its fine port, and many industries are being established there. Durban is also an important port and the industries there have the advantage of being very close to the Natal coalfields which gives them very cheap fuel of all kinds. Port Elizabeth and East London, also on the coast, are rapidly-developing industrial centres and the former is the site of existing and proposed production and assembly plants for motor cars, mainly American. Although there is a sufficient amount of unskilled native labour in the country there is a severe shortage of trained artisans, technicians and professional men of all kinds. Much of the future of industrial development in the Union depends on large-scale immigration and this will be unsuccessful, as I pointed out in my last letter, until the shortages of housing accommodation and water supplies have been eased.

The administration of the Union of South Africa is shared by the central Government and the Provincial Councils. These latter are concerned with:

(1) Education and higher education.
(2) Supervision and maintenance of local authorities.
(3) Supervision and maintenance of hospitals and charitable institutions.
(4) Building and maintenance of roads, bridges and local works within the Province (excepting the National Roads which are planned by the National Roads Board but constructed by the Provinces with funds provided by the central Government). All other administration is done by the central Government including the control of the vast Railways and Harbours Administration which controls the South African Airways also. All mining owned by private enterprise is controlled by the Minister of Mines and there is a Minister of Native Affairs who deals with the problems of allocating land to the natives and controlling the flow of natives to the urban areas without any definite prospects of employment, etc.

To come to the question of the proportions of white and black population, following is the last official table which was drawn up in 1936. There have been increases since then in all sections of the population but I believe the ratio has been fairly well maintained:

Urban Areas.

	Europeans	Natives	Asiatic	Coloured	Total
Cape	503,997	219,229	10,198	356,368	1,089,792
Natal	145,510	127,920	113,549	12,493	399,472
Transvaal	566,066	696,737	21,820	37,591	1,322,214
O.F.S.	91,813	103,988	29	8,455	204,285
Union (total)	1,307,386	1,147,874	145,596	414,907	3,015,763
Rural Areas					
Cape	287,577	1,826,341	310	325,800	2,440,108
Natal	45,039	1,425,709	70,112	6,136	1,546,996
Transvaal	254,690	1,747,643	3,673	13,250	2,019,256
O.F.S.	109,165	449,122	......	9,488	567,775
Union (total)	696,471	5,448,815	74,095	354,754	6,574,135
Total	2,003,857	6,596,689	219,691	769,661	9,589,898

From this it will be easily perceived how small a minority of the population is composed of Europeans, and the need for immigration is made increasingly obvious.

With regard to the prospects for a market for Canadian engineering products, in the pre-war period Canada ranked fourth in the list of countries from whom the Union imported goods. Among the Canadian imports were vehicle chassis and bodies, wood, newsprint, railway track materials, agricultural machinery, base metal manufactures, etc. There is no reason to suppose that the demand for Canadian goods of this type has decreased as there is still a severe shortage of all engineering products in this country. Nearly every existing industry is considering expansion and many new ones are being established in this country, the Government has large-scale plans for developments for the Harbours, Railways and Airports, including the construction of the three new airports I mentioned in my last letter. The severe shortage of housing accommodation caused by lack of materials will take several years to remedy and, meanwhile, all building activity is controlled and so are the commodities used in the trade. The central Government is financing many new housing schemes in the various Provinces and many private enterprises are waiting to go ahead when the supplies situation eases and the Government control is abandoned.

I hope to write more on this subject in later letters.

W. O. Maclaren, M.E.I.C.

Johannesburg, March 24, 1947.

PRODUCTION OF BASIC AND BUILDING MATERIALS—OUTLOOK FOR 1947

The building of houses and the construction of industrial plants and premises depend, among other things, on the flow of building materials. Recently that supply of materials has not been adequate.

Building materials like plumbing, heating or electrical equipment are fabricated out of basic materials like steel, lead, zinc or copper. There have been shortages of these basic materials as well as of manufactured building materials. Producers of these materials were asked to state their production intentions for 1947. The results of this survey show that for most materials output in 1947 will be between 10 and 30 per cent above the level of 1946. In spite of great improvement in the supply situation ahead, not all investment plans will be realized in 1947.

An expanded and uninterrupted production of basic and building materials in Canada is one of the important factors that would help to maintain a high level of employment and income in 1947. Adequate supplies of these materials are necessary to build the houses, hospitals, plants, warehouses, transportation and communication facilities required, and to produce the many consumer goods that have been short in the last eight years.

Basic Materials

Significant production increases are expected during 1947 for seven of the ten basic materials selected for review. Barring unforeseen circumstances, such as prolonged management-labour disputes, increases are likely to range from 11 per cent for asbestos to 35 per cent for steel ingots and to 44 per cent for gypsum. Other important increases expected include pig iron with 36 per cent, nickel 28 per cent, steel castings 24 per cent, and copper with 21 per cent. Only such basic commodities as had already reached peak production indicate but small increases, e.g., lumber up to 6 per cent and lead up 1 per cent; or very little change, e.g., zinc down 1 per cent.

Inventory statistics show five increases in stocks during 1946. The increases were of the order of 7 per cent for lead, 14 per cent for steel ingots, 16 per cent for lumber and 19 per cent for copper. On the whole, inventories held were small in relation to total output or sales. Little accumulation took place during the year.

Building Materials

Among the 29 building material items covered, seven show an expected increase of production of less than 10 per cent. They include: cement, structural tile, gypsum wallboard, gypsum lath, gypsum plaster, cast iron radiators, and paints, varnishes and lacquers.

The next group with probable increases of 10 to 19 per cent includes the following twelve items:—concrete brick and building blocks, cement drain pipe, sewer pipe, water pipe nd culvert tile, building brick (including sand-lime brick), vitrified flue linings, vitrified sewer pipe, asphalt shingles, smooth and mineral roofing products (surfaced rolls), steel pipes, tubes and fittings, wash basins, hot water storage tanks (range boilers), builders' hardware and rigid insulating boards.

Expanded production between 20 and 39 per cent is expected for seven commodities, including bulk rock wool (granulated and loose), cast iron soil pipe and fittings, sinks, furnaces (warm air and heating boilers), electric water heaters and wire nails and spikes. To this group has to be added window glass, the bulk of which is imported from the United States, the United Kingdom, Belgium and Czecho-Slovakia. Increases of 40 per cent or more are indicated for three kinds of building material items, rock wool batts, bath tubs and non-metallic sheathed cable.

Increases in stocks held were recorded for cement products, vitrified flue linings, vitrified sewer pipe, rock wool and gypsum products (excluding gypsum plaster), and all plumbing, heating and electrical equipment items covered (with the exception of bath tubs and hot water storage tanks). On the other hand, a decline in inventories was shown in seven items, including cement, building brick, structural tile, wire nails and spikes, and the three building products mentioned above.

With more basic and building materials available in the coming year, it should be possible for Canada to improve her capital structure, provide for many of the unfilled needs for durable goods needed by the consuming public, and to assist other countries in their effort to re-establish their economies following the ravages of six years of war. Meeting these needs both at home and abroad will mean a significant contribution to the maintenance of a high level of economic activity in Canada in 1947.

ELECTIONS

At a meeting on April 12th a number of applications were presented for consideration, and on the recommendation of the Admissions Committee, the following elections were effected:

Members

Bricout, Pierre, Lic. es Sciences Maths., Dr. es Sciences Physiques, Ecole Poly., Paris; Ing. Elect., Ecole Superieure d'Electricite, Paris, Professor of Elect. Engrg., Laval University, Quebec, Que.

Cummings, George Lewis, B.Sc., (Civil), Alberta, studying for M.Sc., Engrg., (Civil), McGill Univ., Montreal, Que.

Hermanowicz, Tadeusz, Metall. Engr., Mining Academy, Cracow, Poland, chief metallurgist, Sorel Industries Limited, Sorel, Que.

Katz, Allen Elvin, B.Sc., (Elect.), Manitoba, M.M.Miller & Co., Toronto, Ont.

Laidlaw, Clinton T., B.Sc., (Civil), Queen's, city engineer, City of Sarnia, Ontario.

McGill, William James, B.Sc., (Mining and Metall.); M.Sc., (Mining Engrg.), Queen's, industrial engr., Research & Development Branch, Dept. of Reconstruction and Supply, Calgary, Alta.

Osterland, Clifford Donald, B.Sc., (Elect. Engrg.), Alberta, mgr., app. dept., Canadian General Electric Co., Winnipeg, Man.

Powell, Thomas Clifford, B.A.Sc., Toronto, prod. sr. foreman, Nylon divn., Canadian Industries Limited, Kingston, Ont.

Starr, Grant Bondy, B.Sc., (Civil Engrg.), Manitoba, civil engr., Pacific Biological Stn., Nanaimo, B.C.

Juniors

Keough, John Edgar, B.Sc., (Mech.), Queen's, utility engr., steam and power plant, Polymer Corporation Ltd., Sarnia, Ont.

McBride, James Montgomery, B.Sc., (Elect. Engrg.), Alberta, sales engr., Electrical Contracting & Machinery Co., Calgary, Alta.

Takahashi, William Yoshito, B.Sc., (Elect.), Manitoba; B.Sc., (Mech.), British Columbia, jr. engr., Dominion Bridge Co., Ltd., Lachine, Que.

By virtue of the cooperative agreements between the Institute and the associations of professional engineers, the following elections and transfers have become effective.

Alberta

Junior to Member

Samuel, Albert Benjamin, B.Sc., (Civil), Alberta, field engr., engineers' dept., City of Edmonton, Alta.

Student to Junior

Snow, Alfred Harold Grant, B.Sc., (Civil), Saskatchewan, jr. hydraulic engr., P.F.R.A., Spring Coulee, Alta.

Saskatchewan

Member

Goode, Norman John, B.A.Sc., (Civil Engrg.), British Columbia, sr. sanitary engr., Dept. of National Health, Regina, Sask.

Junior

Sundeen, Paul Gustave, B.Sc., (Engr. Physics), Saskatchewan, jr. engr., Saskatchewan Power Commission, Regina, Sask.

Students at University of Saskatchewan

R. H. Bacon	D. B. Dundee	R. W. Potts
C. H. Bell	A. L. Jones	E. W. Wenhardt
J. Bortolotto	H. C. Moulding	G. L. Williams

Junior to Member

Ball, Walter Harvey, B.Sc., (Civil Engrg.), Saskatchewan, research engr. in housing, University of Saskatchewan, Saskatoon, Sask.

Coons, Robert Melvin, B.Sc., (Geo. Engrg.), Saskatchewan, geological asst., F. H. Edmunds, consultg. geologist, Lloydminster, Sask.

Middleton, Jack Spencer Gordon, B.Eng., (Agric. Engrg.), Saskatchewan, asst. city engr., Swift Current, Sask.

Quebec

Member

Marion, Hector Edmond, B.Sc., (Elect.), Queen's, engr., Shawinigan Engineering Co., Montreal, Que.

Admitted as Students

Students at Queen's University

W. H. Agnew	D. A. H. Farmer	D. J. McIntyre
W. M. Axford	M. A. Gill	J. W. McNaughton
A. H. Baker	R. B. Glass	A. A. Merkley
A. D. Brown	A. L. Gourley	D. E. Millikin
C. D. Brown	J. C. Grant	R. L. Motard
F. A. Brown	R. F. Harrison	W. E. Mulholland
C. J. Carter	J. K. Hart	P. T. Nation
D. R. Chinnery	L. N. Herman	E. Park
A. Chipersak	J. Hockman	A. R. Parrish
H. L. Cohen	J. G. Johnson	J. H. Reeves
M. F. Craig	A. Kriger	A. Rutka
D. R. Crichton	E. P. Lewis	A. E. Sibbick
J. D. Crothers	W. K. Lye	N. R. Steenberg
C. F. Donevan	K. Macdonald	H. R. Stephens
H. W. Eby	R. N. Massiah	R. M. Thomson

Students at University of Alberta

A. G. Bray	D. R. Ells	T. H. Newton
G. E. Brown	J. E. Flavin	L. A. Pearce
B. A. Burgess	K. A. Henry	H. Pritchard
L. W. Caldwell	J. F. Hunt	C. W. Pool
G. F. Coates	K. R. Lauer	P. F. Proctor
P. H. Dau	J. E. Maybin	R. A. Spence
F. E. Dembiske	D. F. Moore	D. R. Sutherland
D. D. Dick	K. W. Moore	J. D. G. Wallbridge

Students at University of Toronto

G. R. P. Bulman	F. R. Lepper	J. D. Smith
W. H. Card	W. A. D. Parratt	B. A. Warren
C. A. Fry	G. T. Richards	H. R. Warren
E. D. Knight	R. R. Schieck	R. E. Winter
F. B. Kraft	G. H. Shaw	

Students at University of British Columbia

G. G. G. Baal	A. B. Gatz	M. G. Lum
R. E. Cook	E. C. Hesla	R. D. V. Merritt
R. D. Dunlop	J. Low	J. D. Reid
		D. F. Williamson

Students at University of New Brunswick

S. J. Babin	G. E. Estey	G. H. Peacock
A. L. Bond	J. M. Fletcher	A. J. Rioux
		J. M. White

Students at University of Manitoba

J. L. Bremner	C. D. McCulloch	A. K. Ross
R. E. Johnson	G. I. Mulvihill	E. L. Shanas
		J. E. B. Thorsteinsson

Students at McGill University

J. P. Brais	M. Murphy	W. K. Ross
		W. A. Smyth

Students at Laval University

A. Hogue J. St. Pierre

Students at Nova Scotia Technical College

G. R. Oulton M. Rodinos

Student at Carleton College, Ottawa, Ont.

B. L. Burke

Student at Memorial College, St. John's, N'fld.

J. D. Kent

LeROY FRASER GRANT

PRESIDENT OF THE ENGINEERING INSTITUTE OF CANADA

The career of the well known member of the Kingston Branch who has been chosen as the President of the Institute for 1947-1948 has included activities in many fields of work, in all of which he achieved success. Railway construction, land surveys, municipal projects, irrigation schemes, largely in the West, occupied him as a civilian. He has contributed to the development of engineering education in Canada while serving on the teaching staff of two of our principal engineering colleges. Joining the Institute some forty years ago, he has rendered notable services to the Institute, to its branches and to the engineering profession.

He served in the Canadian Army in both great wars. His record in the field and on the staff speaks for itself.

Born in Toronto in 1884, LeRoy Fraser Grant was educated at St. Alban's School, Berthierville, Que. (later at Brockville, Ont.), and graduated with honours from the Royal Military College, Kingston, in 1905. Later, while on the teaching staff of the Royal Military College in 1926, he received the degree of B.Sc., with honours, from Queen's University.

On graduation from the Royal Military College he entered the Royal Canadian Artillery (Permanent Force) and was one of the two officers to take over the defences of Halifax from the Imperial Government in that year.

In 1907 he left the army to take up civilian engineering work, joining the staff of the Grand Trunk Pacific Railway, and serving as resident engineer at Prince Rupert, B.C., until 1909.

Lieutenant-Colonel L. F. Grant, M.E.I.C.

In 1910 he obtained a commission as a British Columbia Land Surveyor. From 1911 till 1914 he was associated with Dutcher, Maxwell and Co., consulting engineers and surveyors, Vancouver.

On the outbreak of war in 1914 he entered the Canadian Expeditionary Force, going overseas in the following year with the rank of Captain as adjutant of the Canadian Overseas Railway Construction Corps. Two years later he transferred to the 5th Battalion Canadian Railway Troops as second-in-command with the rank of Major. He was mentioned in despatches on three occasions.

On the conclusion of the war he returned to British Columbia. He was then employed by the provincial Department of Lands on surveys for the Southern Okanagan Irrigation Project, continuing land-surveying work until 1921, when he was appointed Instructor in Engineering at the Royal Military College.

Two years later he was made Associate Professor, an appointment which he held with distinction until he entered the Canadian Army in 1939. During this period he commanded the 32nd Field Battery from 1932 to 1936, and the 9th Field Brigade, Royal Canadian Artillery, from 1936 to 1938. He was promoted Lieutenant-Colonel in 1937.

In 1940 Colonel Grant was appointed General Staff Officer, 1st Grade, for Military District No. 3 at Kingston, remaining in that position until he reached the age limit for retirement in 1944. He then became Associate Professor of Engineering in the Faculty of Applied Science in Queen's University, Kingston, an appointment which he still holds.

His interest in the activities of The Engineering Institute of Canada dates from 1908, when he joined as a Student. He was elected an Associate Member in 1913 and a Member in 1927.

His long participation in the administrative work of the Institute has given him first-hand acquaintance with Institute and Branch problems. He was Chairman of the Kingston Branch in 1925, and its Secretary-Treasurer from 1928 to 1937. In 1938, 1939 and 1940 he was a councillor of the Institute, and was one of Ontario's Vice Presidents for 1943 and 1944. He was then appointed chairman of the Institute's Committee on the Training and Welfare of the Young Engineer. Like his predecessor in that position, the late Harry F. Bennett, he has an intimate knowledge of the problems and reactions of the younger section of the profession, and of the importance of the tasks which are being dealt with by that Committee.

The incoming President's chief recreation has long been yachting. Following in the wake of past-president Shearwood and the late Dr. G. H. Duggan he has distinguished himself as a yachtsman. His field of activity has naturally been Lake Ontario, where on several occasions his yacht has won the championship of its class. Twice—in 1945 and 1946—he carried off the Freeman Cup for the long distance race open to yachts on both the Canadian and United States shores of the lake. In 1934 and 1935 he was president of the Lake Yacht Racing Association.

He was instrumental in starting the Kingston Branch of the Navy League of Canada, and is now its Secretary.

Joining the British Columbia Association of Professional Engineers shortly after the first Great War, he relinquished its membership when he moved to Kingston, becoming a Registered Professional Engineer of Ontario in 1938. He is a member of the Professional Institute of the Civil Service of Canada.

The election of Colonel Grant as President of The Engineering Institute of Canada will be welcomed by a wide circle of friends, colleagues, comrades, and former udents. Looking back on his career as engineer, oldier, and professor, it is difficult to say which of these ranches of work is the one in which he has been of the reatest service to the community and to the engineering profession.

Greatly esteemed in private life, he is a man who has never sought publicity. His sound judgment and wide range of experience will enable him to take a prominent part in guiding the present rapid growth and development of The Engineering Institute of Canada.

Personals

News of the Personal Activities of members of the Institute

rnest Lavigne, M.E.I.C., president of the Corporation of Professional Engineers of Quebec has been re-elected as councillor f the Institute to represent the Corporation for 1947. He is re commissioner for the Province of Quebec.

. M. Sauder, M.E.I.C., was re-elected as councillor of the nstitute representing the Association of Professional Engineers of Alberta for the year 1947. He is general manager of he Western Irrigation District at Strathmore, Alta.

A. W. Jennings, M.E.I.C., is the new chairman of the Calgary Branch of the Institute. Born in Saint John, N.B., he attended New Brunswick University, receiving a B.Sc. degree in 1911. He was employed first by the Canadian Pacific Railway, and he spent the summer of 1912 as assistant to the highway engineer of the city of Saint John. Returning to railway work later that year as draughtsman on construction for the National Transcontinental Railway at Saint John, he transferred in the same capacity to Cochrane, Ont., in 1913. He became draughtsman on maintenance for the Canadian Government Railways there in 1915 and was appointed chief clerk to the district engineer in 1915 and assistant engineer (maintenance) in 1916. He was acting division engineer at Cochrane for some time and in 1918 he became assistant engineer for Canadian National Railways at Cochrane, transferring as assistant engineer to Port Arthur the next year. He joined the Alberta Wheat Pool in Calgary in 1927 and is still with the company as superintendent of construction.

R. L. Hearn, M.E.I.C., has been appointed general manager and chief engineer of the Hydro-Electric Power Commission of Ontario. A graduate of Toronto University in 1913, he joined the Ontario Hydro that year and later served with large Canadian and American concerns. He supervised and coordinated engineering and construction of the Polymer Corporation, Sarnia, from 1942-44. He was chief engineer, design and construction, for the H.E.P.C. prior to his recent appointment.

W. D. Black, M.E.I.C., president of the Otis-Fensom Elevator Company Limited at Hamilton, Ont., and past-president of the Canadian Manufacturers' Association, has been elected to the Board of Directors of the Excelsior Life Insurance Company. He is also an executive director of the Royal Bank of Canada and of the Industrial Development Bank of Canada.

A. J. Girdwood, M.E.I.C., chairman of the Peterborough Branch of the Institute, has resigned that office to take up duties in Guelph, Ont., as chief engineer of Leland Electric (Canada) Limited. He is a bachelor of applied science, University of Toronto, 1934, and subsequently took the Canadian General Electric Company's Test Course at Peterborough and Toronto, Ont. He entered the A.C. and D.C. Engineering Department of the Company in 1935, and has a number of patents on synchronous machines to his credit in connection with his work as assistant design engineer on alternating current rotating equipment.

F. R. Pope, M.E.I.C., immediate past chairman of the Peterborough Branch, will resume that office for the unexpired portion of Mr. Girdwood's term. He is assistant superintendent for the Western Clock Company Limited in that city.

E. A. Pinto, M.E.I.C., is technical editor with the British General Electric Company at the Witton Engineering Works, Birmingham, England. He will be remembered as having come to Montreal in the early days of the war as a member of the United Kingdom Technical Mission, transferring later to the Allied War Supplies Corporation. After acting as the Montreal inspection officer to the Inspection Board of the United Kingdom and Canada, he was on the engineering staff of United Shipyards Limited, Montreal, until his return to England in 1945.

The Shawinigan Engineering Company Limited, Montreal, has announced the following appointments affecting members of the Institute: **J. B. Challies,** M.E.I.C., **R. E. Heartz,** M.E.I.C., **E. V. Leipoldt,** M.E.I.C., and **John Morse,** M.E.I.C., have been made directors. **J. A. McCrory,** M.E.I.C., is appointed president; **R. E. Heartz,** M.E.I.C., vice-president and chief engineer; **C. R. Lindsey,** M.E.I.C., and **E. V. Leipoldt,** M.E.I.C., vice-presidents.

A. L. Patterson, M.E.I.C., is assistant chief engineer in charge of all design. **Guy Rinfret,** M.E.I.C., supervising engineer in charge of all construction, field engineering and inspection; **J. B. Macphail,** M.E.I.C., hydraulic engineer; **A. B. Rogers,** M.E.I.C., senior electrical engineer; **J. D. Stott,** M.E.I.C., structural engineer.

A. P. Shearwood, M.E.I.C., has been appointed general sales manager of the National Steel Car Corporation Limited, Montreal. He joined the engineering department of the company at Hamilton, Ont., in 1932, was transferred in 1934 to the Montreal Office, and in 1937 became mechanical assistant to the president.

M. F. Ker, M.E.I.C., on completion of 25 years' service as engineer of Stamford Township, Ont., received from the Township Council at its March meeting this year a resolution ascribing to him much of the credit for industrial development in the section. It was emphasized that his far-seeing planning programme has attracted large industries to the township, and has enabled it to benefit of the great tourist interest in Niagara's Canadian section.

E. F. Barratt, M.E.I.C., has been appointed city engineer for North Bay, Ont., He was formerly engineer and road superintendent for the County of Wentworth, Ont.

A. Raymond, M.E.I.C., vice-president and general-manager of the International Braid Company of Canada Limited, Ste. Rose, Que., has been appointed president of Safeway Heat Elements of Canada Limited. This organization will operate on the premises of the International Braid Company.

G. Percy Cole, M.E.I.C., technical engineer of the Dominion Glass Company Limited, Montreal, has been elected to fellowship in the Society of Glass Technology, at a meeting of the Board of Fellows and Council of the Society held at Sheffield, England, in January, 1947.

G. St. Jacques, M.E.I.C., has been appointed transportation engineer with the Provincial Transport Company, Montreal. He was previously engineer-economist with the Provincial Transportation and Communication Board of Quebec at Montreal.

W. H. Hooper, M.E.I.C., of Amalgamated Electric Corporation Limited, Toronto, has received the appointment as manager, apparatus sales, in charge of distribution equipment and Canadian Cutler-Hammer sales. He joined the company in 1939, serving as field engineer until 1945, when he was named manager, distribution equipment sales, which position he occupied upon his recent promotion.

G. G. M. Carr-Harris, M.E.I.C., is now permanently with the National Research Council in Ottawa, Ont., and no longer on loan to the Department of Reconstruction and Supply. He is, however, still with the Technical Information Service.

Roger Lord, M.E.I.C., took office at the beginning of this year as manager of the town of Cap-de-la-Madeleine, Que. He was formerly assistant to the resident engineer at the power house of the Beauharnois Light Heat and Power Company at Beauharnois, Que.

H. S. Nicklin, M.E.I.C., city engineer of Guelph, Ont., the 1946-47 chairman of the Canadian Section of the American Water Works Association, presided at the opening of the 27th Annual Meeting of the Section in Montreal on April 14th.

F. J. Veale, M.E.I.C., superintendent of Waterworks, Hamilton, Ont., was elected chairman of the Canadian Section of the American Water Works Association for 1947-48, at the Annual Meeting in April in Montreal.

J. D. Mollard, JR.E.I.C., is now with the Water Development Branch of the P.F.R.A. in Regina, Sask. He graduated in 1945 with a B.Sc. from University of Saskatchewan and attended Purdue University, Lafayette, Ind., in 1946-47, serving as a graduate assistant while obtaining an M.Sc. degree.

W. J. C. Gall, S.E.I.C., is no longer with the Canada and Dominion Sugar Company at Chatham, Ont. He travelled via England and France to Switzerland, where he has been attending the University of Zurich since April 15th this year.

A. H. Hoffer, S.E.I.C., is with the General Electric Company in Schenectady, N.Y. He is assistant product engineer assigned to the special products section of the electro-mechanical division of the general engineering and consulting laboratory.

NEWLY ELECTED OFFICERS OF THE INSTITUTE

R. S. Eadie, M.E.I.C., has been elected vice-president of the Institute for the province of Quebec. Born at Hintonburgh Ont., he was educated at McGill University where he obtained the degree of B.A.Sc. in civil engineering in 1920 and the degree of M.Sc. in 1922. His course was interrupted in 1916 when he joined the Royal Canadian Engineers as a lieutenant and served in Canada and overseas until the end of the war.

After graduation Mr. Eadie accepted a position as lecturer in the Department of Applied Mechanics at McGill and remained in that position until 1924. In that year he joined the staff of the Dominion Bridge Company at Montreal. He has been associated with the company since that time. In 1935 he was appointed designing engineer and in October 1937, was made assistant chief engineer. In February, 1944, he became chief engineer of the Eastern Division of the company, which position he holds at the present time.

Mr. Eadie joined the Institute as a Student in 1914, transferring to Junior in 1920, to Associate Member in 1926 and to Member in 1936. He was a member of the executive committee of the Montreal Branch in 1939-40, vice-chairman in 1942 and chairman in 1943. He served as councillor representing the Montreal Branch from 1944 until 1945.

W. L. Saunders, M.E.I.C., is the newly elected vice-president of the Institute for the province of Ontario. Born at Goderich, Ont., he studied engineering at the University of Toronto. He was engaged in railway engineering from 1907 until 1915 when he enlisted in the Canadian Expeditionary Force. He held the rank of lieutenant in the 6th Battalion of Canadian Railway Troops, serving in France from 1917 until 1919. For two years following his discharge he was employed as assistant engineer with the Canadian Pacific Railway in Saskatchewan on construction and maintenance. Since 1922 he has been with the Department of Highways of Ontario, his present position being that of resident engineer.

Mr. Saunders joined the Institute as a Student in 1910, becoming a Junior in 1913, an Associate Member in 1920 and a Member in 1940. He served as chairman of the Ottawa Branch in 1944 and in the following year was elected councillor of the Institute representing the Ottawa Branch.

S. G. Coultis, M.E.I.C., has been elected vice-president of the Institute for the Western provinces. Born at Forest, Ont., he was educated at the University of Michigan, where he graduated in chemistry in 1909. He was employed by Smith and Leisenring as a chemist from 1909 until 1913 when he went to Calgary as assistant chemist with the city. In 1917 he became superintendent of the Southern Alberta Refineries and three years later was given the same position with the Royalite Oil Company at Black Diamond, Alta. In 1937 he returned to Calgary where he is now with the Valley Pipe Line Company Limited as president and general manager.

Mr. Coultis joined the Institute as a Member in 1926. He served as councillor representing the Calgary Branch in 1942-43.

L. E. Mitchell, M.E.I.C., is the newly elected councillor of the Institute representing the Halifax Branch. Born at Campobello, N.B., he graduated from Mount Allison University in 1930 with a B.A. degree and from the Nova Scotia Technical College in 1932 with a B.Sc. in mechanical engineering. He joined the staff of the Halifax refinery of the Imperial Oil Limited on graduation and has been in the employ of this company and its South American subsidiaries ever since. Mr. Mitchell served for a period of six years with the International Petroleum Co. Ltd. in Peru and the Tropical Oil Company in Colombia. He is at present chief engineer of the Halifax refinery.

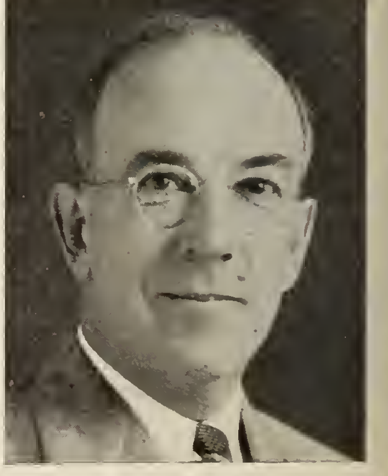
Mr. Mitchell joined the Institute as a Student in 1930. He transferred to Associate Member in 1940 and became a Member in the same year. He served as chairman of the Halifax Branch in 1945.

C. D. McAllister, M.E.I.C., has been elected councillor of the Institute representing the Saint John Branch. Born at Saint John, N.B., he graduated from the University of New Brunswick in 1918 with the degree of B.Sc. in civil engineering.

For two years following graduation he was employed with the Canadian Pacific Railway in the New Brunswick and Algoma districts as engineer maintenance of way. The next three years were spent in municipal engineering with the City of Saint John, after which he was employed on investigation and construction pertaining to hydro-electric de-

R. S. Eadie, M.E.I.C.

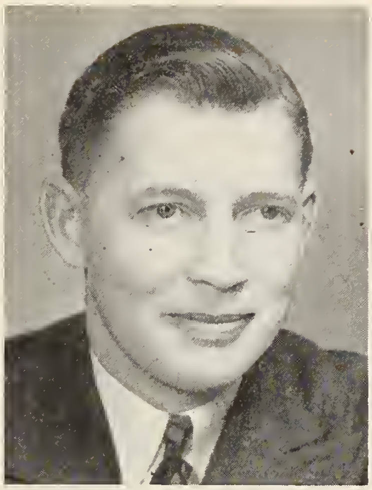
W. L. Saunders, M.E.I.C.



S. G. Coultis, M.E.I.C.

L. E. Mitchell, M.E.I.C.

W. J. Thomson, M.E.I.C.



Viggo Jepsen, M.E.I.C.

elopment in New Brunswick and Quebec. After some time ent on road construction in his native province he entered ie Department of Public Works of Canada at Saint John 1928. He is at present senior assistant engineer in the ew Brunswick district for the same department.

Mr. McAllister joined the Institute as a Member in 1942. e served as chairman of the Saint John Branch in 1944.

'. J. Thomson, M.E.I.C., has been elected councillor of the istitute representing the Saguenay Branch. Born at Orillia. nt., he graduated from Queen's University with a B.Sc. egree in 1927. After graduation he was employed for a ear by Treadwell Yukon Mines, Bradley, Ont., in the impling, surveying and assay laboratory. In 1929 he worked or American Cyanamid, Niagara Falls, Ont., on the analysis f raw materials. In the following year he joined the staff f the Abrasive Company of Canada as a chemist at Hamilon, Ont. In 1938 he was transferred to Arvida, Que., where e is at present managing director of Simonds Canada brasive Company Limited.

Mr. Thomson joined the Institute as a Junior in 1913, ransferring to Associate Member in 1936. He became a Member in 1940.

ules A. Beauchemin, M.E.I.C., has been elected one of the ouncillors of the Institute representing the Montreal Branch. Born at Montreal, Que., he graduated from Ecole Polyechnique with a B.A.Sc. degree in 1911. Upon graduation e became associated with the Federal Hydrometric Service t Ottawa where he remained until 1919. At that time he oined the staff of the Riordon Pulp Corporation at Temisaming, Que., as the engineer in charge of the study of hydrolectric developments. Two years later he severed his conection with Riordon Corporation to become chief engineer f Donnacona Paper Company where he remained until 1927 vhen he was appointed town manager for the new town of Dolbeau in the county of Lake St. John, Que. Mr. Beauhemin was in charge of the plans, organization, public works and services, acting for the Lake St. John Power and Paper Company Limited which was developing the new townsite. In 1930-31 he was manager of personnel and properties for the Consolidated Paper Corporation at Port Alfred, Que., and in the following year was employed as resident engineer on the construction of the Wellington Street Tunnel, under the Lachine Canal, representing the City of Montreal. In 1932, Mr. Beauchemin was resident engineer of the Lake St. Louis Bridge Corporation, later becoming comptroller of the same organization. In 1935 he was appointed chief engineer of the Provincial Electricity Board at Montreal, which position he holds at the present time.

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

Mr. Beauchemin joined the Institute as an Associate Member in 1919, becoming a Member in 1940. He served as chairman of the Montreal Branch in 1946.

Viggo Jepsen, M.E.I.C., has been elected councillor of the Institute representing the St. Maurice Valley Branch. Born and educated in Denmark he came to Canada in 1928. He joined the staff of the Shawinigan Water and Power Company, Limited where he was engaged in power development In 1932 he went with James A. Ogilvy's Limited, Montreal as sales engineer for oil burning equipment. For a few months in 1936 he worked on the installation of caustic treatment plant at the Canadian Copper Refineries Limited, Montreal. Later in the same year he joined the staff of Consolidated Paper Corporation, Limited, in the Laurentide Division at Grand'Mere, Que., and soon became chief draughtsman. He is at present division engineer with the company at Grand'Mere.

Mr. Jepsen joined the Institute as a Junior in 1932, transferring to Associate Member in 1938. He became a Member in 1940. He served as chairman of the St. Maurice Valley Branch in 1942.

K. G. Cameron, M.E.I.C., is one of the newly elected councillors of the Institute representing the Montreal Branch. Born in London, England, he graduated from the University of Edinburgh with a B.Sc. degree in 1912. Following graduation he came to Canada and was employed from 1912 until 1916 with the Grand Trunk Railway at Montreal on inspection and supervision of various construction projects. After one year in charge of inspection of munition steel for the Canadian Inspection Company at the plant of Nova Scotia Steel and Coal Company at New Glasgow, he returned to railway works for some months but in 1917 was recalled to the Nova Scotia Steel and Coal Company. For a year he was responsible for all inspection and in 1918 became office assistant to the superintendent of machine shops and hydraulic forge department. In 1919 he was employed as chief draughtsman in the mechanical department of Dominion Iron and Steel Company at Sydney, N.S. Four years later he went to Montreal and became chief engineer of Canada and Dominion Sugar Co. Limited. He subsequently became town manager of Hampstead, Que., which position he holds at the present time.

Mr. Cameron joined the Institute as a Jun-

K. G. Cameron, M.E.I.C.


C. E. Gelinas, M.E.I.C.


J. R. Carter, M.E.I.C.


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

ior in 1914, transferring to Associate Member in 1920. He became a Member in 1940.

C. E. Gelinas, M.E.I.C., has been elected one of the councillors of the Institute representing the Montreal Branch. Born at Three Rivers, Que., he received the degree of B.A.Sc. from Ecole Polytechnique in 1911. For three years after graduation he was employed as draughtsman and designer with Trussed Concrete Steel Company. After one year as superintendent of construction for Archambault and Conway, contractors, at Montreal, he joined the staff of T. Pringle and Son as checker on reinforced concrete.

In 1915 Mr. Gelinas became city engineer of Grand'Mere. Que., and from that date until 1922 served also as manager of the Municipal Power Company and as engineer with the Laurentian Pulp and Paper Company. From 1922 until 1926 he was employed as city engineer at Three Rivers, Que. The next four years were spent in the paper industry. In 1931 he was employed by the City of Montreal where he now holds the position of engineer superintendent of maintenance and construction.

Mr. Gelinas joined the Institute as an Associate Member in 1924, becoming a Member in 1940. He was a charter member of the St. Maurice Valley Branch of the Institute which he helped to organize in 1925.

J. H. Irvine, M.E.I.C., has been elected councillor of the Institute representing the Ottawa Branch. Born at Nile, Ont., he graduated in civil engineering from the University of Manitoba in 1912. After extensive experience in general construction work he was appointed representative of the Dominion Reinforcing Company Limited at Toronto in 1928. In 1932 he entered the city engineer's department at Ottawa, Ont. His present position is that of office and designing engineer of the City of Ottawa.

Mr. Irvine joined the Institute as a Student in 1911, transferring to Associate Member in 1917. He became a Member in 1940. He served as chairman of the Ottawa Branch in 1946.

J. R. Carter, M.E.I.C., is the newly elected councillor of the Institute representing the Kingston Branch. Born at Kagawong, Ont., he graduated from the University of Toronto with a B.A.Sc. (civil) in 1931. Following graduation he joined the Hydro-Electric Power Company of Ontario. From 1933 until 1936 he was employed by the Department of Northern Development as resident engineer on highway construction, after which he spent some months on development and prospecting with mining companies in northern Ontario. In 1937 he became designer in the engineering department of the Canadian Johns-Manville Co. Limited at Asbestos, Que. Mr. Carter then joined the staff of Canadian Industries Limited at Montreal and in 1941 was transferred to the nylon division at Kingston, Ont., where he is at the present time.

Mr. Carter joined the Institute as a Student in 1931, transferring to Associate Member in 1937. He became a Member in 1940.

Carson F. Morrison, M.E.I.C., is the newly elected councillor of the Institute representing the Toronto Branch. Born at File Hills, Sask., he graduated from the University of Saskatchewan with the degree of B.E. (civil) in 1925. Two years later he received his M.Sc. degree in structural engineering at McGill University. Mr. Morrison joined the staff of the University of Alberta in 1927 and in the following year he went to the University of Toronto where he is now associate professor of civil engineering.

Mr. Morrison joined the Institute as a Junior in 1929, transferring to Associate Member in 1936. He became a Member in 1940. He served as chairman of the Toronto Branch in 1945.

V. A. McKillop, M.E.I.C., has been elected councillor of the Institute representing the London Branch. Born at West


(Photo Ashley & Crippen)
C. F. Morrison, M.E.I.C.


V. A. McKillop, M.E.I.C.


A. H. MacQuarrie, M.E.I.C.

S. T. McCavour, M.E.I.C.

N. B. Hutcheon, M.E.I.C.

F. R. Burfield, M.E.I.C.

Lorne, Ont., he graduated from the University of Toronto with a B.A.Sc. degree in 1924. On graduation Mr. McKillop joined the staff of the Public Utilities Commission at London, Ont., as assistant engineer and two years later was promoted to engineer. He is at present assistant manager of the Commission.

Mr. McKillop joined the Institute as a Junior in 1926, transferring to Associate Member in 1927. He became a Member in 1940.

A. H. MacQuarrie, M.E.I.C., is the newly elected councillor of the Institute representing the Border Cities Branch. Born at Tansley, Ont., he graduated from the University of Toronto with a B.A.Sc. degree in 1914. From 1919 until 1921 he was employed as draughtsman with the Canadian Bridge Company at Windsor. For the year following he worked as laboratory engineer with the Ford Motor Company of Canada and in 1922 returned to his former position with Canadian Bridge Company. The next year he worked as squad foreman in charge of tower department draughting and in 1927 was made sales engineer on designing, estimating and contracting, specializing in transmission towers and substation structures.

Mr. MacQuarrie joined the Institute as a Member in 1941.

Neil B. Hutcheon, M.E.I.C., professor in mechanical engineering at the University of Saskatchewan, has been elected councillor of the Institute representing the Saskatchewan Branch. Born in Rosetown, Sask., he graduated from the University of Saskatchewan with the degree of B.Sc. (Mech. Eng.) and M.Sc. in 1933 and 1935 respectively. He spent the two years after graduation in research work at the University of London, University College, London, England, returning in 1937 to the University of Saskatchewan, Saskatoon, as assistant professor in mechanical engineering.

Mr. Hutcheon joined the Institute as an Associate Member in 1938, becoming a Member in 1940. He served as chairman of the Saskatchewan Branch in 1945.

S. T. McCavour, M.E.I.C., has been elected councillor of the Institute representing the Lakehead Branch. Born at St. John, N.B., he graduated from the University of New Brunswick in 1920. After graduation he became engaged in the pulp and paper industry and in 1929 joined the Great Lakes Paper Company Limited, Fort William, Ont., as resident engineer. In 1931 he was promoted to his present position of chief engineer and joint manager.

Mr. McCavour joined the Institute as a Member in 1941. He served as chairman of the Lakehead Branch in 1944.

F. R. Burfield, M.E.I.C., is the newly elected councillor of the Institute representing the Edmonton Branch. Born and educated in England, he became employed with the Department of Interior, Irrigation Office, at Calgary, Alta., in 1913. From 1916 until 1919 he served with the Allied Armies and, on demobilization, returned to his former position with the Dominion government where he remained until 1930. For the eight years following he worked as inspecting engineer with the Water Resources Office, Province of Alberta, Edmonton, and in 1938 he became chief engineer which position he holds at the present time.

Mr. Burfield joined the Institute as a Member in 1916. He served as secretary-treasurer of the Edmonton Branch from 1941 until 1944, and as chairman of the Branch in 1945.

S. C. Montgomery, M.E.I.C., was elected councillor of the Institute representing the Kootenay Branch. Born at Winnipeg, Man., he graduated in mechanical engineering from McGill University in 1915 with the degree of B.Sc. After four years service overseas with the Canadian Expeditionary Force in World War I, he was employed in 1919 by the Whalen Pulp and Paper Company, Woodfibre, B.C., going in 1920 to the Western Canada Pulp and Paper Company at Port Mellon, B.C.

S. C. Montgomery, M.E.I.C.

(Photo by Stanley, Vancouver)

T. V. Berry, M.E.I.C.

C. B. Hamilton, Jr., M.E.I.C.

In 1923 he entered Pacific Mills Limited, Ocean Falls, B.C., as mechanical draughtsman, becoming assistant to the resident engineer in 1924 and assistant mechanical superintendent in 1926. Two years later he entered the employ of the Consolidated Mining and Smelting Company of Canada Limited at Trail, B.C., where he now holds the position of maintenance engineer.

Mr. Montgomery joined the Institute as a Student in 1911, transferring to Junior in 1920. He became an Associate Member in 1929 and a Member in 1940. He was appointed councillor representing the Kootenay Branch when it was inaugurated in 1946.

T. V. Berry, M.E.I.C., is the newly elected councillor of the Institute representing the Vancouver Branch. Born in England he came to Canada at an early age and received his education at the University of British Columbia where he graduated in 1923 as a B.A.Sc. Upon graduation he was engaged for a year in hydro-electric surveys and investigations made for the City of Vancouver. In 1924 he joined the staff of the City of Vancouver as an assistant in the municipal engineering department and two years later he became assistant engineer with the Greater Vancouver Water District. He is now treasurer of the Greater Vancouver Water District and secretary-treasurer of Vancouver and Districts Joint Sewerage and Drainage Board.

Mr. Berry joined the Institute as an Associate Member in 1934 becoming a Member in 1940. He served as chairman of the Vancouver Branch in 1944 and as secretary-treasurer of the Branch for several years.

Chester B. Hamilton, Jr., M.E.I.C., has been appointed councillor of the Institute representing The American Society of Mechanical Engineers, as a result of the agreement between the Institute and the Society.

Born at Toronto, Ont., he graduated from the University of Toronto with a B.A.Sc. degree in 1907. In 19[illegible] he was employed as a draughtsman with Johnston Oil Engine Company and for the next two years worked on specification and inspection work with Smith Kerry and Chace. In 1911 Mr. Hamilton founded his own business The Hamilton Gear & Machine Company, of which he is still the president.

Mr. Hamilton joined the Institute as a Member in 1918. He holds a Life Membership in The American Society of Mechanical Engineers.

INSTITUTE PRIZE WINNERS

Lorne A. Campbell, M.E.I.C., president and managing director of the West Kootenay Power and Light Company, Trail, B.C., has been awarded the Sir John Kennedy Medal of the Institute for 1946. The citation which accompanies the award reads as follows:

"The Sir John Kennedy Medal, the highest award of the Institute, is being presented this year to a man who over the years has consistently occupied a high place in engineering esteem. His attainments and the high regard with which he has been held were early evidenced when at the tender age of 22 he was given the important post of chief engineer of the Canadian General Electric Company in Toronto.

Lorne A. Campbell, M.E.I.C.

"He later moved to the new mining community of Rossland in British Columbia, where he became general manager of the newly-formed West Kootenay Power and Light Company Limited. Subsequently he rose to the position of vice-president, and then president and managing director of the company. He is also president of the McGillivray Creek Coal and Coke Company Limited and a director of the Consolidated Mining and Smelting Company of Canada Limited.

"He continues to make his home in Rossland, where he has lived for nearly 48 years and he still takes an active interest in local community affairs, particularly with regard to hospitals.

"Living in the days when the west was distinguished for its giants, Mr. Campbell attained pre-eminence among them. The story of the development of the power resource of the Kootenay River parallels the story of the development of Trail. It is the story of his life, and, too, is a part of the proud story of Canada's industrial achievement.

"The Institute is proud to recognize Mr. Campbell's wide accomplishments, and is proud of his membership in the society."

Charles Camsell, M.E.I.C., past-president of the Institute, is one of the recipients for 1946 of the Julian C. Smith Medal awarded by the Institute for "achievement in the development of Canada". The citation, read upon presentation of the medal at the annual dinner, is as follows:

"Born at Fort Liard in the Northwest Territories, the story of the life of Dr. Camsell is the story of the development of the West. He has seen and participated in an expansion of territory and activity that is unique in the history of any land, and yet he remains young and active and as keen as ever.

"His travels took him into many obscure parts of Canada —on foot, by dog train, by canoe and by pack train—always seeking out the facts related to minerals, water power and a multitude of natural resources.

"With all this as a background he became Deputy Minister of what is now the Department of Mines and Resources, a post which he has filled with great distinction for twenty-seven years.

(Photo courtesy C.I.M.M.)

Dr. Charles Camsell, M.E.I.C.

"As was his due, he has been the recipient of many honours including an LL.D. from Queen's and one from Alberta. He has been awarded the Murchison grant of the Royal Geographical Society for his services as an explorer, and the Founder Medal by the same society, the gold medal of the Institution of Mining and Metallurgy of Great Britain for his interests in the natural resources of Canada, the R. B. Bennett Empire prize for his paper on 'Canada's New North', and last year the medal of the Professional Institute of the Civil Service of Canada in recognition of his contribution to science and administration during his fifty years of public service.

"In the King's Birthday List of 1935 he was made a Companion of the Order of St. Michael and St. George.

"In 1932 he was president of The Engineering Institute of Canada and this year is president of the Canadian Institute of Mining and Metallurgy.

"It is most fitting that a great Canadian so successful in developing our great country should be awarded the Julian C. Smith Medal of the Institute."

J. B. Challies, M.E.I.C., past-president of the Institute, and vice-president and executive engineer with The Shawinigan Water and Power Company, Montreal, is one of the recipients of the Julian C. Smith Medal of the Institute for 1946. The citation which accompanies the award reads as follows:

"This gentleman is known in every mainland province for his leadership in the conservation of the water resources of the Dominion. As the founder of the Hydrometric Survey of Canada, the organization that measures their flow, organizer of the Dominion Water and Power Bureau that promotes their best use, vice-president of one of the great electric utility corporations whose main duty is to see that the power of several large Quebec rivers is harnessed to serve the public interest, he has achieved a knowledge of river lore that is unique and unrivalled.

"Dr. Challies received his diploma in civil engineering from the old 'School' here in Toronto in 1903; the degree of Civil Engineering in 1908 and the honorary degree of Doctor of Engineering in 1938.

Dr. J. B. Challies, M.E.I.C.

"In The Engineering Institute of Canada he has held practically every office from secretary of the Ottawa Branch in 1908 to the presidency in 1938.

"He has sat in every court of the United Church of Canada, and for several years has been chairman of the Board of Governors of The United Theological College, Montreal.

"Last year he was chairman of the Canadian Chamber of Commerce.

"In addition to a senior vice-presidency in The Shawinigan Water and Power Company, Dr. Challies is a director of several important hydro-electric and industrial corporations. A recognition he prizes highly is honorary membership in the Professional Institute of the Civil Service of Canada, an organization of which he was one of the founders. His 23 years in the Federal Civil Service and his subsequent similar period in the service of the Shawinigan companies, involving responsibilities of constantly increasing importance in respect of the study, the conservation and the use of the water resources of Canada, is being fittingly recognized by the Institute in the award of the Julian C. Smith Medal."

A. K. Leuthold, M.E.I.C., of Montreal, Que., is the recipient of the Duggan Medal and Prize of the Institute for 1946 for his paper "The Application of the Gas Turbine to Railway Locomotives" which appeared in the August 1946 issue of *The Engineering Journal.*

Born in Zurich, Switzerland, Mr. Leuthold graduated in 1927 as an electrical engineer from the Swiss Federal Polytechnical College at Zurich. Soon after graduation, he joined Brown Boveri and Company at Baden, Switzerland, where he spent several years on research on high voltage and high current mercury arc rectifiers. In connection with this occupation, he put into service many large rectifier installations for electrified railway and city-subway systems as well as for large electrolytic plants in various European countries. In 1935 he successfully put into operation several substations for the South African Railways.

From 1931 until 1937 Mr. Leuthold made several trips to Canada in connection with some high capacity rectifier installations in large electrolytic plants. In 1938 he joined permanently the staff of Brown Boveri Canada Limited, where he is still employed as chief engineer.

J. G. G. Kerry, M.E.I.C., of Port Hope, Ont., has been awarded the Gzowski Medal of the Institute for 1946 for his paper "The Winter Temperature Cycle of the St. Lawrence Waters" which appeared in the January 1946 issue of *The Engineering Journal.*

Born at Montreal, Que., he graduated with honours from McGill University with a B.A.Sc. degree in 1886. Six years later he received his M. Eng. degree there. After graduation some years were spent on the engineering staffs of railway lines in Canada and the United States. In 1893 Mr. Kerry joined the teaching staff of the Faculty of Applied Science, McGill University, where he remained until 1907.

In 1898 he became a partner in Smith, Kerry & Chace, later Kerry & Chace Limited, with which firm he remained until his retirement. From 1907 until 1932 Mr. Kerry acted as consulting engineer of the Temiskaming and Northern Ontario Railway. He also constructed power plants for several companies including Nipissing Power Company, Seymour Power & Electric Company, Canada Cement Company and Hollinger Gold Mines. The paper mills which he constructed included those for Northumberland Paper & Electric Company and Canadian Paperboard Company.

Among the executive positions occupied by Mr. Kerry was that of president, Northumberland Paper & Electric Company; president, Seymour Electric Power Company and associated companies; president, Canadian Paperboard Company; president, Quinte & Trent Valley Power Company; and secretary of Boundary Investments Limited. Mr. Kerry retired in 1939.

George Gedge, C.I.M.M., of Timmins, Ont., is the recipient of the Leonard Medal for 1946 for his paper "Safety in the Handling and Use of Explosives at Hollinger Mine" which was published in the December 1945 issue of *The Canadian Mining and Metallurgical Bulletin.*

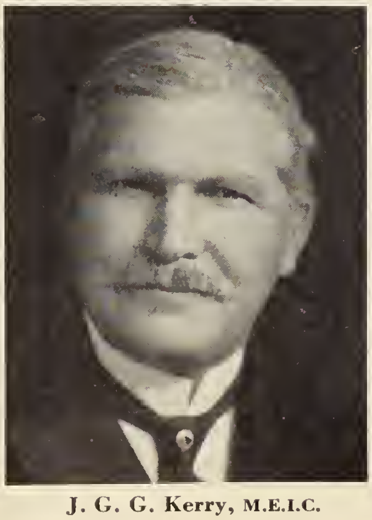
Born in Brazil, Mr. Gedge received his education there and in England. In 1913 he entered the employ of the St. John del Rey Mining Company under a four-year agreement, on the expiration of which he went to England and joining the Royal Air Force, served as an observer until he was shot down and taken prisoner about three months before the end of the war.

In 1919 Mr. Gedge returned to St. John del Rey and held positions successively as charge man, assistant mine captain, and mine captain until 1929. In the following year he joined the staff of Hollinger Consolidated Gold Mines as shift boss. In 1932 he was placed at the head of the underground safety department, the position he now holds.

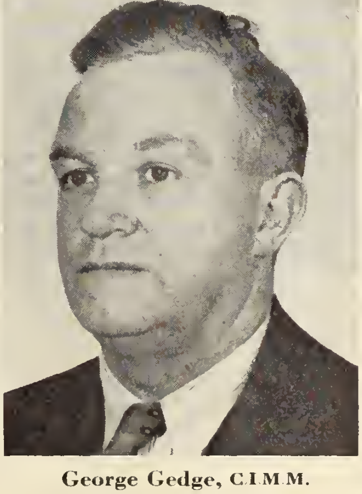
W. J. Tomlinson, M.E.I.C., Montreal, Que., is the recipient of the Plummer Medal of the Institute for 1946 for his paper "Modern Methods of Conditioning Boiler Water Externally" which appeared in the September 1946 issue of *The Engineering Journal.*

Born at Newark, N.J., he attended Lehigh University at Bethlehem, Penn., graduating with a B.Sc. in chemical engineering with honours and the Senior Chemical Engineering

A. K. Leuthold, M.E.I.C.



J. G. G. Kerry, M.E.I.C.



George Gedge, C.I.M.M.

W. J. Tomlinson, M.E.I.C.

R. M. Hardy, M.E.I.C.

E. D'Appolonia, M.E.I.C.

Prize in 1931. In 1936 he received the professional degree of Chemical Engineering from the same institution.

After working on the plant engineering staff of Koppers Gas & Coke Co., Kearny, N.Y., Mr. Tomlinson joined the technical department of W. H. & L. D. Betz, Philadelphia, specialists in the field of water conditioning. In 1938 he came to Canada as technical director for Betz Laboratories Division of Wood Industries Supply Company, later becoming manager and technical director for Betz Laboratories Limited. In October 1946 he joined E. F. Drew & Co. Ltd., Montreal, as technical director in the water treatment division, which position he holds at the present time.

R. M. Hardy, M.E.I.C., and **E. D'Appolonia,** M.E.I.C., are the recipients of the Keefer Medal of the Institute for 1946 for their paper "Permanently Frozen Ground and Foundation Design" which appeared in the January 1946 issue of *The Engineering Journal.*

R. M. Hardy, Dean of the Faculty of Applied Science at the University of Alberta, Edmonton, was born at Winnipeg. He graduated with a B.Sc. in civil engineering from the University of Manitoba in 1929 and obtained a Master's degree from McGill University in 1930. The same year he joined the staff of the University of Alberta as a lecturer in the Department of Civil Engineering. He was later appointed assistant professor and in recent years became associate professor. Dean Hardy spent a number of summers at the University of Michigan, studying structural engineering, and during the session 1939-40 he went to Harvard University where he studied soil mechanics, a field in which he has become recognized as an expert. He has done consulting work for the past twenty years for industrial concerns both in eastern and western Canada, one of his most important assignments being with the Aluminum Company of Canada. He has also given extensive advice on structural and foundation problems in Alberta.

E. D'Appolonia was born in Coleman, Alta., in 1918. He attended the University of Alberta from 1938 to 1942, receiving a B.Sc. in civil engineering. In the summer of 1942 he was employed by the Aluminum Company of Canada as a designer. Returning to the University in the fall, he taught there until 1946, and completed requirements for a M.Sc. degree, graduating in 1946. During the summers of 1943 to 1945 he was employed by the United States War Department as a structural engineer, and it was during this period that the investigations and studies pertaining to permanently frozen ground in Canada and Alaska were carried out. At present he is completing the requirements for a doctorate at the University of Illinois. The field of major study is in structural engineering with minors in mathematics and theoretical and applied mechanics.

A. B. Hunt, M.E.I.C., Montreal, Que., has been awarded the Ross Medal of the Institute for 1946 for his paper "The Future of Radio Communications in Canada" which appeared in the February 1946 issue of *The Engineering Journal.*

Born at London, Ont., he graduated from the University of Toronto with a B.A.Sc. degree in 1928, when he was awarded a medal from the British Association for the Advancement of Science, which is the highest engineering award of the University. Upon graduation, he joined the Northern Electric Company and since that time has been actively associated with radio communication. His early years with the company were spent as a manufacturing methods engineer in connection with theatre sound system and vacuum tube production. In 1931 he was appointed assistant operating superintendent in charge of radio and other associated lines. During 1935 he was given the additional responsibility of engineering and designing the products he was manufacturing. When a separate division of the company was established in 1938 to handle the expanding business in the electronics field, Mr. Hunt was appointed manager, which position he holds at the present time.

A. B. Hunt, M.E.I.C.

E. M. Scott, S.E.I.C., has been awarded the H. N. Ruttan Prize of the Institute for 1946 for his paper, "The Operation and Construction of the Modern Oil Circuit Breaker".

Mr. Scott was born in Winnipeg, Man. Entering the University of Manitoba in 1942, he followed a course in electrical engineering and graduated in 1946. It was during summer employment with the Winnipeg Electric Company that the information and knowledge was obtained which made possible the writing of this paper. He was chairman of the Student Section of the Winnipeg Branch of the Institute, when that section was formed during his final year at University. He is at present located in Toronto, where he is employed on the Test Course with the Canadian General Electric Company.

Obituaries

The sympathy of the Institute is extended to the relatives of those whose passing is recorded here.

George D. Archibald, M.E.I.C., a former chairman of the Saskatchewan Branch of the Institute, died suddenly on March 22nd. He was born in 1886 at Truro, N.S., studied at King's University in Windsor, N.S., and worked first as a draughtsman with the Dominion Iron and Steel Company at Sydney, N.S. In 1905 he went to Winnipeg where he worked for the old Grand Trunk Pacific Railway on location. Within two years he joined the Canadian Northern Railway as maintenance of way engineer. In 1911 he went into the private contracting business, and during this time built many miles of road and journeyed to Philadelphia, Pa., where he did more of that type of work. Shortly after, he worked on the Welland Canal when it was under construction. In 1914, he began his life's work as city engineer of Saskatoon, Sask. The following year he was appointed superintendent of the street railway system. He held both posts up to the time of his death.

Perhaps the biggest achievement of his career was the building of the Skeena Highway between Prince Rupert and Hazelton, B.C., during the Second World War. Recognized by the Federal Government as an expert on highway construction, he was loaned by the city of Saskatoon for about two years to take charge of this project which ranks next to the building of the Alaska Highway.

Mr. Archibald took great pride in Saskatoon and, throughout the years, he played a leading role in construction of landmarks which will remain as monuments to his ability and progressive ideas. He was engineer in charge of construction of the Broadway Bridge, he built the city incinerator and developed the first municipal airport, and he successfully reclaimed the McCraney slide. He designed the Nineteenth Street subway and developed the pumping station to keep it abreast of the city's development. The Lorne Avenue diversion which eliminated two dangerous railway level crossings was his design, and he planned the sewage disposal plant now under construction. He also endeavoured to combine beauty with usefulness, instigating the construction of the stone revetment walls along the river banks and planning the terraces which now add to the beauty of that part of the city. Shortly before he died, he received the approval of the city council on his plans for the conversion of the city's street railway system to trolley busses.

Mr. Archibald joined the Institute in 1938 as a Member.

George Breck Mitchell, M.E.I.C., who was resident engineer for T. Pringle and Son at Magog, Que., died on March 25th, 1947, in Sherbrooke, Que. He was born in Philadelphia, Pa., in 1875, and studied civil engineering at the Colorado State School of Mines, Golden, Col., graduating in 1896. He was associated in 1897 with William Cramp and Son of Philadelphia, as draughtsman and assistant to the chief engineer, and the following year he became assistant engineer with the United States Deep Waterway Commission and was located at Ogdensburg, N.Y., and Detroit, Mich. In August, 1899, he was located at Nicaragua as assistant engineer with the Isthmian Canal Commission. One year later he became office engineer in Washington for the same commission. He entered private practice in 1902 as a member of the firm, A. J. Norris and Company, Amsterdam, N.Y., but in September of the same year he accepted a position with the Canadian Pacific Railway Company as assistant engineer at the Angus Shops, Montreal. Two years later he was placed in charge as assistant engineer of the mechanical work of the company's engineering department at Montreal In December, 1905, he accepted the position of superintendent of buildings with the New York, New Haven and Hartford Railroad at New Haven, Conn.

He went to C. E. Deakin Limited, general contractors, Montreal, in 1907, as vice-president, and remained until 1916 when he entered private practice as a general contractor with headquarters in Montreal, and the next year he joined the staff of the Foundation Company of New York, with charge of projects in various parts of the United States and in Lima, Peru. In 1923 he went to Victoria, B.C., as western manager for P. Lyall and Sons Construction Company and he was transferred by the company to Bogota, Colombia, three years later. Returning to Montreal, he joined the Atlas Construction Company in 1930 as general superintendent and director. In 1937 he was at Kewagama, Que., with the Wood Cadillac Mines Limited, and later joined the Fraser Brace Engineering Company Limited, serving at Nobel, Ont. From 1940 to 1942 he was general superintendent of the Dufferin Shipbuilding Company Limited, Toronto, and was connected with the Davie Shipbuilding and Repairing Company at Lauzon, Que., until 1946, when he joined T. Pringle and Son at Magog, Que.

An active Member of the Institute since 1913, Mr. Mitchell was chairman of the Victoria Branch, and Councillor of the Institute in 1925.

Stanley G. Moseson, JR.E.I.C., of Critchley, Alta., assistant general manager of Fred Mannix & Company Limited, Calgary contractors, was killed in an airplane crash at Coaldale, Alta., February 14th, 1947. He was born in Wetaskiwin, Alta., and attended school there and at Camrose, Alta. He graduated with a B.Sc. in civil engineering from the University of Alberta in 1942, and was with the Calgary Power Company Limited at Banff and Seebe, Alta., for a year before joining the Mannix Company as field superintendent. He was made assistant general manager in 1945.

He joined the Institute as a Student in 1941, transferring to Junior in 1945.

ERRATUM

THE SMOKE PROBLEM, *by* E. A. Allcut, M.E.I.C.

Listed below are captions which should have accompanied figures illustrating the article, "The Smoke Problem", in the April issue of the *Journal*.

We apologize to the author and to our readers.

Illustrations

1. (a) Coarse grit from power station chimney; (b) Fine grit from power station chimney — Same scale
2. Distribution of smoke in Toronto 1932-3.
3. Effect of filtering and washing in removing small particles. (Maclaurin)
4. Smoke distribution in Leicester 1937. (H. M. Stationery Office)
5. Smoke survey by Stevens Institute, indicating origin. (H. N. Davis)
6. Sources of smoke in survey at Leicester (redrawn).
7. Building up of fine carbon particles on textile fibre. (Electron microscope after Watson)
8. Automatic air filter, water operated. (Casella & Co.)
9. Principle of thermal precipitator.
10. The Ringelmann chart.
11. Errors in estimating density of smoke from stacks of different diameters by using Ringelmann chart. *(Mechanical Engineering)*
12. Owen's smoke density indicator. (Institution of Mechanical Engineers)
13. Method of using Owen's indicator. (Institution of Mechanical Engineers)
14. Air jets in rear wall of travelling grate stoker. (Battelle Memorial Institute)

News of the Branches

Activities of the Twenty-eight Branches of the Institute and abstracts of papers presented

BORDER CITIES BRANCH

G. W. Lusby, M.E.I.C. - - . . *Secretary-Treasurer*
W. R. Mitchell, M.E.I.C. - *Branch News Editor*

A joint dinner meeting of the Border Cities Branch of the Institute and the Association of Professional Engineers of Ontario was held on March 14 in the Prince Edward Hotel with Chairman A. D. Harris, presiding.

The guest speaker was Dr. G. B. Langford, president of the Association, who gave a thought-provoking address on **The Engineer and the State.**

Dr. Langford was accompanied to Windsor by Colonel Tom Medland, public relations director for the Association. Colonel Medland spoke on current activities of the Association and also on his particular duties in publicizing the engineer and his work.

The dinner was preceded by a reception at which all present had an opportunity to meet and talk with the guests.

The meeting wound up with a discussion period in which a large proportion of those present took part.

EDMONTON BRANCH

W. W. Preston, Jr.E.I.C. - *Secretary-Treasurer*

Weather forecasts may soon be expressed in terms of human comfort. This was the forecast of Dr. Thomas How, officer in charge of the Dominion Public Weather Office in Edmonton, in an address to the Edmonton Branch, at its dinner meeting on the evening of April 7th, in the Macdonald Hotel. Speaking on the subject **Measuring Wind-Chill,** Dr. How stated that research is in progress to devise a system of numbers, known as wind-chill values, which will express the effect produced on the human body by evaporization of moisture on the skin, by convection currents, and by radiation of heat to or from the body. The unit of wind-chill is a kilogram calorie per square meter per hour. As the weather becomes more severe, the wind-chill numbers become larger. It was found on a Byrd Antarctic Expedition that one's cheeks would freeze at a W.C. value of from 1500 to 1600. An important fact to be kept in mind while interpreting W.C. readings, the speaker said, is that the values are based on the criterion that the person has been comfortable and that on exposure to more severe weather he is still comfortable.

Dr. How prefaced his paper with comments on the weather forecaster's problems. Daily he receives many requests from people in all walks of life for 36-hour forecasts. Among these people are engineers in firms whose business is affected by the weather. One of the forecaster's chief worries is in expressing himself. He must describe the state of the sky,—clear, cloudy, overcast; the wind,—velocity; the weather—precipitation, fog; and the temperature trend,—number of degrees warmer or colder than the forecast for the previous day. The difficulty, the speaker stated, is to express this data in plain English briefly enough to send reports by telegram yet clearly enough to be understood.

Research on wind-chill needs a man with the qualifications of a medical man, engineer, meteorologist, research physicist and one familiar with the hydrodynamics of fluids. The human body produces heat through the normal action of the internal organs or by exercise, and retains or gets rid of this heat in different ways, in order to regulate the body temperature to a constant value of 98.6°F. The external conditions which influence this regulation are evaporization of moisture from the skin requiring latent heat; exchange of heat between the body and warmer or cooler moving air; and radiation, which may be caused for example by the sun or a block of ice. Relationships between these quantities are complicated because of their variability. However, in northern regions where evaporization and radiation factors are small enough to be neglected, a simple relationship obtains. This applies only to our winter forecasts. First experiments on wind-chill consisted simply in taking a thermometer from a heated room to the outside temperature and recording the changes of temperature. Later, on a Byrd expedition to Antartica, a cylindrical plastic container was designed. It was filled with water, heated above freezing and allowed to cool. A record of the calories released per hour was kept. Present endeavours are to standardize the cylindrical measuring apparatus.

Engineers, the speaker continued, are concerned with insulation. The U.S. Army has studied wind-chill and the insulation of clothing, but no literature has been available during the war. It is known that as humidity increases, the insulation quality decreases. Dr. How suggested that heating and ventilating engineers should consider wind-chill in studying the insulating properties of walls.

The meeting was under the chairmanship of J. W. Porteous. L. A. Thorssen introduced Dr. How, and K. Cumming proposed a vote of thanks which carried unanimously. Attendance was 36.

HALIFAX BRANCH

J. D. Kline, M.E.I.C. - - *Secretary-Treasurer*
M. L. Baker, M.E.I.C. - - *Branch News Editor*

The March meeting, one of special interest, was held at the Nova Scotian Hotel on March 20th. At this meeting the members welcomed the president of the Institute, J. B. Hayes, who paid his official visit to the Halifax branch at this time.

In honour of the president the wives of the members were guests at the dinner. Members and guests numbered 142. Accompanying Mr. Hayes were the regional vice-president, C. M. Anson, Assistant General Secretary Louis Trudel; and Councillor G. J. Currie, E. C. O'Leary, chairman of the Branch, presided at the meeting.

Following the dinner a toast to the ladies was ably proposed by W. C. Risley and graciously responded to by Mrs. Hayes.

Mr. Hayes in his most interesting and enjoyable address described his recent trans-Canada presidential tour and also recounted many of his experiences on his visit to England last fall when he attended, as Canadian representative, the conference of the engineering institutions of the Commonwealth. In the course of his talk Mr. Hayes paid tribute to Dr. F. H. Sexton, retiring president of the Nova Scotia Technical College, to whom he referred as " a man who has done much for the profession in this Province ".

Mr. Anson spoke briefly on labor management relations. He uphelp the right of workers to organize and told the members that if employees are treated fairly and reasonably they will respond with their full co-operation.

Mr. Trudel gave a concise report on the activities of the Institute during the past year. He said the objective of the Harry Bennett Educational Fund was in sight and pointed out that already, through the fund, assistance in engineering training was in effect.

I. P. Macnab, in proposing a vote of thanks to Mr. Hayes, outlined the latter's career as a student at Mount Allison, Dalhousie, at the Nova Scotia Technical College, and as a soldier in World War I. He traced the president's activities with the Nova Scotia Light and Power Company from the time he entered it as field engineer under Mr. Macnab's supervision to the present time.

At the conclusion of the speeches a musical programme was presented by Harry Cochrane and accompanying artists.

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Thursday morning, March 20, Mr. Hayes addressed the students of the Nova Scotia Technical College and St. Mary's College in the Assembly Hall at the Nova Scotia Technical College. Dr. Sexton, president of the Technical College, presided. Messrs. Anson, Trudel, Currie and O'Leary were members of the president's party.

Before addressing the students Mr. Hayes presented to J. Oakley, senior mechanical engineering student, the certificate for the Institute prize which he won last year, and to H. McClymont, junior mechanical engineering student, the Institute prize for the term 1946-47. Then, in a most inspiring talk, the president referred to the many phases of engineering he encountered on his presidential visit across Canada and on his visit to England in 1946.

Mr. Anson spoke of the value to industry of men with engineering training. He pointed out that there were opportunities in Nova Scotia for young men with such training, and it was these men who were needed to cope with and solve the many problems that arise in industry.

Mr. Trudel gave the students a comprehensive picture of the objectives of the Institute and reviewed the work of the organization during the past year.

HAMILTON BRANCH

L. C. Sentence, m.e.i.c. - *Secretary-Treasurer*
I. M. Macdonald, jr.e.i.c. - *Branch News Editor*

The Annual Students' and Juniors' night of the Hamilton Branch of the Institute was held at McMaster University on Thursday, March 20th, 1947. Forty members attended the meeting which was opened by Chairman E. G. Wyckoff, and presided over by Neil Metcalf.

Four papers were presented in competition for the Branch prizes, as follows:

1. **Modern Engraving Practices,** by W. A. Freeman, s.e.i.c. Mr. Freeman, introduced by G. L. T. Vollmer, is a graduate in mechanical engineering from the University of Toronto, and is superintendent of the Barnard Stamp & Stencil Company Limited.
2. **Comparative Costs of Stage and Compound Dies,** by L. G. Galloway, s.e.i.c. Mr. Galloway, introduced by A. A. Moline, is an honour graduate of the University of British Columbia in mechanical engineering, and is now an engineering apprentice, Canadian Westinghouse Company Limited.
3. **Lightning Effects on Buried Telephone Cable,** by R. N. E. Haughton, s.e.i.c. Introduced by Norman Eager, Mr. Haughton is an electrical engineering graduate of Queens University. He is with the transmission engineering department of the Bell Telephone Company of Canada.
4. **Some Aspects of Atomic Energy,** by L. A. Cook, jr.e.i.c. Mr. Cook is a graduate of Queens University in engineering physics, and was introduced by A. A. Moline. He is at present an engineering apprentice with Canadian Westinghouse Company Limited.

After the judges W. E. Brown, Neil Metcalf and E. H. Tovee, had reached a decision, Mr. Haughton was presented with the first prize. Second place went to Mr. Galloway, and third to Mr. Cook. Mr. Freeman's paper was given honourable mention by the judges who recommended that all four papers be submitted for the Galbraith prize of the Institute.

At the conclusion of the papers, a discussion period was held and A. R. Hannaford expressed the appreciation of the meeting by moving a vote of thanks to the four speakers.

LETHBRIDGE BRANCH

H. T. Miard, m.e.i.c. - - *Secretary-Treasurer*
E. A. Lawrence, s.e.i.c. - *Branch News Editor*

The joint meeting of the Lethbridge Branch of the Institute and the Association of Professional Engineers of Alberta was held in the Marquis Hotel, Friday, March 21st, 1947, commencing with a dinner at 6.30 p.m.

L. C. Stevens, president of the Association, presided; head table guests included Mayor J. A. Jardine, J. Harper Prowse, J. Randle, Dean R. M. Hardy, R. S. Lawrence, chairman of the Branch, J. S. Irwin, J. G. Dale, Julian Garrett.

J. Randle introduced the speaker, Dean R. M. Hardy of the University of Alberta who spoke on **Engineering Education.** Dean Hardy stated that there is a very large number of students registered in Canadian Universities for the course in Applied Science and mentioned the University of Toronto with 4,000, University of Alberta with 980, and the total in Canada of 14,000.

Engineering students graduating in applied science from University of Alberta in 1949 will be about 300, and in 1950 about 400, when it is expected the intake will be back to normal. About 75 percent of the students registered in engineering courses are war veterans and the standard being attained by these men was never higher, due, the speaker thought, to their more mature minds and broader outlook.

Therefore a large influx of engineers can be expected in 1949 and 1950, and provision must be made now by the engineering societies, and Canadian society as a whole to absorb these men into the business and industrial life of Canada. There are some bright spots in the picture. Canadian society could make far greater use of technically trained men than it has done in the past. Furthermore, other parts of the British Empire and the United States of America would absorb some of them, although loss of technically trained men to other countries is being deplored. In addition, Canadian industry could be expanded to absorb a large number, and the speaker thinks this is the proper course to pursue.

Dean Hardy mentioned that the Senate of the University of Alberta was thinking of broadening the Engineering curriculum to include some non-scientific subjects to give the young engineer a broader outlook and a better approach to the problems of today. Should this idea be adopted then the course in applied science would become a five-year course in place of the present four years.

J. S. Irwin thanked the speaker for his excellent address.

MONCTON BRANCH

V. C. Blackett, m.e.i.c. - *Secretary-Treasurer*

On February 4th an unusually large attendance of branch members and their ladies heard G. R. Murray of the Canadian General Electric Company, Saint John, N.B., speak on the **All Electric Home.**

Illustrating his remarks with slides, Mr. Murray took his listeners on a tour of the modern home. He showed the various forms of lighting used to illuminate the grounds about the house, and the electrical appliances, such as doorbell chimes, two-way radio to announce callers, and an electric bell to signal the arrival of mail. Inside the house, lumiline and fluorescent lights cast an even glow over the rooms, instead of the old-time concentration of light in the centre, leaving the corners dark and dingy. As Mr. Murray declared, nowadays we do not merely light rooms—we light-condition them—we move the sun indoors. In the kitchen of the all electric home, cooking, dish washing and garbage disposal were shown to have become largely a matter of throwing switches and pushing buttons. The speaker concluded with a description of methods of ventilation and oil heating systems having automatic electric control.

A vote of thanks was extended Mr. Murray by T. H. Dickson, the presiding chairman, on motion of B. E. Bayne, seconded by G. L. Dickson.

MONTREAL BRANCH

E. M. Van Koughnet, m.e.i.c. - *Secretary-Treasurer*

Congratulations are extended by the Montreal Branch to L. F. Grant newly-elected President of the Institute for 1947 and to the new members of Council.

We are pleased that the suggestion put forward by this Branch to hold a conference of Executive Committee Members at the Annual General Meeting, has been accepted. This conference, attended by one or two members from each branch, provides for closer contact between those representing the different sections of the country than is ordinarily possible at the Annual Meeting. Branch problems of both a particular and general nature can be discussed and ideas, information and assistance exchanged.

J. A. Beauchemin, Chairman of the Montreal Branch Campaign Committee for the Harry F. Bennett Educational Fund wishes to take this opportunity to thank all those who assisted in conducting the Campaign canvass and to express his gratitude to the members for their generous contribution to this very worthy cause.

Recent guest speakers at the Thursday evening meetings have been: T. W. Mowat of Ottawa who described **High Voltage Direct Current Generators for Nuclear Research;** McNeely DuBose who delivered, in F. L. Lawton's absence, the latter's paper on **Economics of Water Diversion;** G. Lorne Wiggs who spoke on **Radiant Heating** and Dr. J. J. Green and H. S. Rees who gave a paper on the **Direct Operating Costs of Transport Aircraft.**

Montreal Branch Members receiving recognition at the Annual Meeting in Toronto are:

J. B. Challies: the Julian C. Smith Medal for Achievement in the Development of Canada.

A. B. Hunt: the Ross Medal for his paper "The Future of Radio Communication in Canada."

A. K. Leuthold: the Duggan Medal and Prize for his paper "The Application of the Gas Turbine to Railway Locomotives."

W. J. Tomlinson, the Plummer Medal for his paper "Modern Methods of Conditioning Boiler Water Externally."

Dr. Ernest Brown of McGill University: an Honorary Membership.

Members are reminded that reciprocal agreements now in force permit E.I.C. members to avail themselves of the publications of other similar societies on the same basis as their own membership. A list of these societies with their publications can be obtained at Headquarters.

NIAGARA PENINSULA BRANCH

P. A. Pasquet, jr.e.i.c. - - *Secretary-Treasurer*
C. A. O. Dell, m.e.i.c. - - *Branch News Editor*

Members and friends of the Niagara Peninsula Branch held a dinner meeting at the Queensway Hotel in St. Catharines, on Thursday, March 20th.

President W. D. Brownlee, occupied the chair, and after the dinner called upon C. Climo, member of the branch executive, who introduced the speaker of the evening, J. C. Thwaites, of the Electronics Division of Canadian Westinghouse Company, Hamilton. Mr. Climo spoke of an earlier acquaintance with the speaker at Queens University, and assured the audience of an interesting evening to come.

Mr. Thwaites, subject was **Atomic Power in Industry,** and in his opening remarks he made the assertion that, of the immense and far-reaching scientific development in electronics and electrical science which had taken place during the war, practically all was based on Maxwell's four equations. Using these equations it can be shown that the best insulation for high frequency currents is copper placed at the nodal points of the wave. Copper is also one of the best conductors of electricity.

The speaker traced some of the highlights in the development of the Ignitron tube for purposes of producing aluminum during the war. The first Ignitron tube was put into service for this purpose at Messina, N.Y., in 1939. At the beginning of the war, Canada was producing about 350,000 lb. of aluminum per day. Orders were received to jump up this production and development of the equipment was immediately started. The first aluminum was poured from the new equipment on August 10, 1941. Canada now produced about 4,000,000 lb. of aluminum per day, and at one time during the war had a stockpile amounting to a 10-acre field piled 40 feet deep. In spite of the tremendous production during the war, production for the month of March, 1947, was expected to be higher than for any month during the war.

The speaker also told of the development of electronic equipment which was used to upset the aim of the German V2 bomb which was controlled from the ground by radio for the first 50 seconds of travel. The Germans were able to tell the course and speed of these bombs by means of radio signals sent out from the bomb to an operator at the starting point. By means of other signals sent to the bombs, they were able to steer them for the first 50 seconds of flight. The method of upsetting the aim was to introduce another signal from the coast of Britain which was received by the German ground operator. This signal was composed in such a way as to combine with the signal from the flying bomb and give a net effect to the German operator such as to make the bomb appear to be lower and more horizontal than was actually the case in its line of flight toward England. The operator would then send out impulses to raise the line of flight of the bomb. The net result would be that the bomb would curve back over the French coast to land on German-held territory. About 2900 of these bombs were directed at Britain during the war. They travel at about 500 miles an hour. Although there is only 50 seconds' time during which the course of a bomb could be influenced, nevertheless by the method described the operators of the interfering equipment were able to detect and upset the aim of some 900 out of the total of 2600.

Several other types of equipment were described and the speaker drew attention to the amazing equipment developed by Perce Level for shooting down the V1 bomb. The V1 bomb travels at about 400 miles per hour and carries no radio control equipment, but can be detected by sight due to the intense torchlike tail fire. Equipment used against this bomb consisted of two telescopes connected to an electronic device about the size of a suitcase. Two operators trained the telescopes on the bomb and followed its line of flight for one second. In this short period of time, all necessary information about the line of flight and the speed of the bomb was set up in the electronic calculating device by means of the motions of the telescopes in following its course. This information was automatically transmitted to an anti-aircraft battery of three guns, along with several other variables such as temperature, barometric pressure, humidity, etc. which affect the aiming of anti-aircraft guns. The guns, loaded with shells equipped with proximity fuses, were automatically aimed from the electronically recorded information. At a given signal, an A.T.S. girl would pull the lanyard firing three shells only, and 20 seconds later would expect to see a terrific explosion in the sky. The speaker, on a night of observation, saw these girls knocking down 95 per cent of the bombs coming over.

Another amazing development was the Shoran Radar, by means of which targets from 50 to 75 miles away were bombed by remote control. By use of this equipment, a bridge in Italy which had eluded bombing raids for weeks was hit on the first bombing run using the equipment. Three bombs were dropped, with one falling just short of the target, one just beyond, and one dead centre.

Mr. Thwaites concluded by giving great credit to British scientists and to the British people for their scientific contributions and vigorous prosecution of the war. Among other things developed by the British, he mentioned Fido, Pluto, and Radar. The first indication of radar was observed by Watson Watt in England when he received reflections from the R101, which flew over his station during experiments. This discovery led to the erection of short wave transmitter stations on the east coast of England which, though ostensibly for short wave transmission, were actually for radar detection work.

The meeting closed with a vote of appreciation to Mr. Thwaites.

OTTAWA BRANCH

C. G. Biesenthal, Jr.E.I.C. - *Secretary-Treasurer*
R. C. Purser, M.E.I.C. - - *Branch News Editor*

Industrial Lighting was the subject of an address, with accompanying motion picture, "Let Us See", at a noon luncheon of the Branch on Thursday, March 27, at the Chateau Laurier. The speaker was Major G. D. Mills, representing the Ottawa Chapter of the Illuminating Engineering Society.

The basic factors concerning vision are four in number: size of object looked at, contrast of object with surroundings, time to accommodate eye to view, brightness. The last mentioned is the factor that may be controlled by illumination.

The amount of light given by a candle at one foot distance is called a foot-candle and is a standard unit of measurement. At noon on a normally bright day, there may be as much as 10,000 foot-candles of light outside, whereas inside a room the light from a window may vary from one foot-candle upward.

In the past 15 years the science of illumination has made wonderful strides, and it has been found that comfortable seeing, without undue eyestrain to a worker, may be aided by the avoidance of: (a) harsh shadows in and around work, (b) bright or flaring lights within line of vision, and (c) excessive brightness ratio around the work; and by the provision of enough light for the particular job in hand.

Regarding item (c), the brightness ratio should be kept well within 10:1 and preferably 3:1. Thus there should be no dark walls and brightly lighted machines, and the decorating scheme should be tied in with the working operations. The amount of light required, naturally, may vary from one task to another.

The speaker referred his listeners for further information on this subject to a booklet, "Recommended Practice for Industrial Lighting", adopted in the United States in 1943 and now approved by the Canadian Efficiency Standards Association and accepted in this country by the Canadian Department of Labour for practice here.

Chairman Major-General G. R. Turner presided. Major Mills was introduced by R. M. Prendergast, president of the Ottawa Branch of the A.I.E.E., and thanked by William C. Brown. The chairman announced that Gordon Murphy, an Ottawa Branch member, would shortly leave to reside in Montreal, where he has been appointed port manager.

PETERBOROUGH BRANCH

A. R. Hailey, M.E.I.C. - - *Secretary-Treasurer*
J. C. Allan, M.E.I.C. - - *Branch News Editor*

Professor G. A. Wallace of the Electrical Engineering Department of McGill University addressed a dinner meeting of the Peterborough Branch of the Institute on Saturday, March 22nd at the Kawartha Club. About 110 members and guests were present, including visitors from Toronto with representatives from the Bell Telephone Company, the Hydro Electric Power Commission, the Toronto Transportation Commission and the Canadian General Electric Company.

Chairman A. J. Girdwood introduced Professor Wallace, who spoke on **The Inductive Co-ordination of Power and Telephone Lines.**

The speaker gave a very lucid explanation of a highly technical subject, starting with a description of the part of the extended subject to be treated. He explained that there are two kinds of interference between power and telephone lines. They are due to magnetic induction and electrostatic interference. The interference might be otherwise classified as normal interference and transient interference. The paper presented confined itself to a discussion of inductive interference, and normal rather than transient interference.

Noise, for the purposes of telephone men, is measured by its interference with the intelligibility of speech. A graph was presented to show that sounds of about 1,050 cycles produce the most interference, and that sounds below 250 cycles or above 4,000 cycles produce very little interference. Noise meters have been produced to compensate for these differences in interference. They may have scales in milli-amps or in decibels. A perfect transmission line produces no interference, and a perfect telephone line will not pick up any interference, but no one can construct perfect lines of either kind, so that inductive co-ordination is necessary. In other words, co-operation is required between the power company and the telephone company in every locality.

The speaker described and illustrated researches in co-ordination, which he had conducted in Alberta and in Quebec, and analyzed the causes of interference in each case.

Following the presentation of the paper there was a general discussion in which representatives of the Bell Telephone Company and the Hydro Electric Power Commission were prominent. They stressed the happy co-operation which there has been between their organizations in dealing with these problems.

The vote of thanks was moved by E. W. Henselwood of the Canadian General Electric Central Station Department, Toronto.

SAGUENAY BRANCH

J. E. Dyck, M.E.I.C. - - - *Secretary-Treasurer*

A Programme for Improvement of Maintenance Methods was the subject of an address given by H. A. Estabrook to the Saguenay Branch of the Institute on March 20, 1947.

Mr. Estabrook for the past three years held the position of superintendent of the Industrial Engineering Department at the Arvida Works of the Aluminum Company of Canada, Limited. His address was based on the paper delivered by him at the Time Study and Methods Conference sponsored jointly by The Society for the Advancement of Management and The American Society of Mechanical Engineers in New York in April, 1946.

The speaker discussed briefly the processes and operations carried on in the Arvida Works pointing out the large quantity and variation of equipment which has to be kept in operating condition by the maintenance forces. It was decided by the plant management that a consulting firm of engineers should be called in to investigate this maintenance problem.

The method of attacking this problem followed several definite lines:

Identifying the principal causes of high maintenance cost and setting up the means for effectively getting these costs back into line.

Preventive maintenance through scheduled plant inspections of apparatus and equipment, with follow-up.

Improvement of the methods and practices of the maintenance crews themselves.

Review of the storeskeeping of maintenance supplies to revise order points, requisitions routines and material controls.

Review of the organization of maintenance work, both in its relation to the operating departments and in its internal structure.

Establishment of budgets which would reflect the "should cost" for maintenance work, and the setting up of the necessary executive reports which would bring to the top officials the records of performance against budgets and other standards established.

An analysis of maintenance work revealed that a substantial proportion of the repairs were of a highly repetitive nature and specialized crews were set up to handle these on a routine basis. The size of the crews were determined after making extensive time studies on this work. The setting-up of standard crews and methods was accomplished by a committee composed of representatives of the maintenance department and the industrial engineering department.

To control labour efficiencies on varied maintenance, the jobs were planned daily by use of the Gantt Chart. In this way man-hours for each job were scheduled and performance was later compared with the schedule.

Budgets for maintenance were established based on past performance as to material costs but based on the new standard crews for labour costs. As improved equipment and methods are introduced the budget is revised accordingly. Executive reports giving a graphic picture of maintenance costs per unit of production in the various plants were introduced. In addition to these such costs as maintenance of yards, trucks, buildings and equipment were charted.

The mechanical department organization itself was changed to some extent. The function of mechanical inspection was decentralized placing an inspector in each plant reporting directly to the maintenance supervisor of that plant. An engineering section was set up within the mechanical department for purposes of carrying on development work designed to reduce maintenance costs.

Mr. Estabrook illustrated his talk with a number of slides showing improvements resulting from the programme carried out.

B. E. Bauman thanked the speaker on behalf of the branch.

Junior Section

T. T. Anderson, jr.E.I.C. - *Secretary-Treasurer*

A meeting of the Junior Section of the Saguenay Branch was held at the Arvida Protestant School at 8.15 p.m. on Thursday, March 28th. K. V. Gow, of the Aluminum Company of Canada Limited, addressed the meeting on the subject of **Ceramics.**

Mr. Gow discussed generally what ceramics and ceramic engineering involves and the industries which they include. He traced the history of the ceramic industry from prehistoric man to the present day and cited the development of porcelain and glass as examples. Manufacturing processes for porcelain, refractories, structural brick, and tile, etc., were outlined briefly. Compositions of electrical and chemical porcelain were discussed and possible uses for highly refractory pure oxide ceramics such as alumina zirconia, etc. were mentioned. The compositions and methods of manufacture of some special glasses such as Pyrex, Vycor, Fiberglas were described.

Following his talk, Mr. Gow showed the following films: Manufacture of Continuous Filament Fiberglas; Sand and Flame—A Film on Manufacture of Glass and Safety Glass; Looking through Glass—A Reel Dealing with Optical Glass.

The meeting proved exceptionally interesting to everyone The speaker was introduced by J. T. Madill, chairman of the Junior Section, and thanked by B. L. Davis.

SASKATCHEWAN BRANCH

D. W. Houston, M.E.I.C. - *Secretary-Treasurer*
L. A. Dokken, M.E.I.C. - *Branch News Editor*

The annual meeting of the Saskatchewan Branch was held Friday, February 19th, 1947, at the Saskatchewan Hotel in Regina with over ninety members in attendance. Morning and afternoon sessions were devoted to business and a good turnout of the general membership was in evidence. Reports from committee chairmen of both Regina and Saskatoon Branches were heard and approved. The secretary reported an increased membership and an improved financial condition of the Branch.

At six thirty an informal reception was held, followed by dinner, at which the guest speaker was the Hon. J. L. Phelps, Minister of Natural Resources for the Province of Saskatchewan. Mr. Phelps outlined the problems of his department when planning the development of the various resources in the Province. He stressed the fact that in many cases plans had been made on projects which can not be carried out at present due to the lack of trained men, notably engineers. As such the long range view must be taken, and in the interim the department is endeavouring to train men by the medium of short courses of instruction which will enable them to get by "until such time as the trained engineers are available". Mr. Phelps commented briefly on each of the resources to which attention is being given, and spoke of the difficulties he has encountered in each of the projects inasfar as immediate large scale development is concerned.

W. O. Longworthy, in thanking the speaker, said that he was pleased that the problem of natural resources development was considered by Government officials to be essentially a technical one, and that he felt sure that the utmost co-operation of the engineering bodies could be counted upon in assisting the development of the various projects.

In the absence of Chairman-elect E. K. Phillips, Vice-chairman Stewart Young tendered his appreciation to the speaker and declared the meeting adjourned.

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The regular monthly meeting of the Saskatchewan Branch was held on Friday, March 14th, 1947, at the Kitchener Hotel in Regina.

Branch Chairman E. K. Phillips presided, and after the introduction of guests, announced that the chairmanship of the monthly dinner meetings would be rotated among members of council, the next chairman being E. S. C. Carpenter. He then introduced the speaker of the evening, J. H. Palmason, superintendent of operation, Western Region, Canada Creosoting Company.

The speaker discussed **Methods of Wood Preserving** and first commented briefly on the importance of the field to the nation and gave statistics to show the volume of creosoting business handled throughout the Dominion. Although "tie" treating for the railways constituted the bulk of the work, an ever increasing amount of "pole" and "pile" treating is being done.

The methods used to treat various materials were outlined, and the process for "butt treating" and the three basic pressure systems were described. It is most important to have the wood in a good condition to absorb the creosote and oil mixture, absence of free moisture and air being especially helpful. Air seasoned wood gave best results, but fair results are being obtained with artificially seasoned material. This process was developed as part of the war emergency programme.

The speaker then discussed various treatment control methods, e.g. depth of penetration and amount of absorption, and illustrated the effect of wood cellular structure in obtaining the quality of treatment required. Cedar gives best results, and woods such as fir are very difficult to treat since the penetration is not uniform. Research on wood treating is being carried on with the hope of being able to guarantee proper treating of most woods in the near future. The shortage of cedar is bringing out the substitute woods and the problem is being tackled by the wood treating industry.

Figures show the average life of an untreated tie to be ten years, whereas treating adds at least eighteen years to this figure. Railway statistics show a saving of 8.1c a year on each treated tie as compared to the untreated, and the total estimated annual savings to all Canadian Railways will approximate eleven million dollars.

E. Durnin, in thanking the speaker, mentioned that due to the predominance of "power" men and highway engineers in our merbership, the information on "pole" and "pile" treating was especially interesting. Mr. Durnin pointed out also that the whole field had been clearly outlined by the speaker and thanked Mr. Palmason for the work and attention he had given the subject.

TORONTO BRANCH

E. G. Tallman, M.E.I.C. - *Secretary-Treasurer*
E. R. Graydon, M.E.I.C. - *Branch News Editor*

Labour Relations and the Engineer was the subject at the March meeting of the Toronto Branch, held in the Debates Room, Hart House, at the University of Toronto. Chairman Edgar Cross presided, and Professor R. F. Legget introduced the speaker, W. F. Clive Kidd.

Mr. Kidd graduated from the University of British Columbia and took post-graduate studies in Economics at the University of Toronto. As research director of the United Steelworkers of America, at Toronto, Mr. Kidd was closely concerned with the critical labour negotiations of the past few years and was able to present an intimate review of these with particular attention to the steel industry.

Mr. Kidd's talk was roughly divided into two parts: the strikes in 1946, and union plans for 1947. His remarks applied not only to his own union, but to all associated Canadian Congress of Labour unions.

Strikes in 1946 were attributed to five main factors: the drop in take-home pay; rise in cost of living; the desire of management for a test of strength; the attitude of the government; and the desire for a rise in the workers' standard of living. Mr. Kidd discussed all these points thoroughly, giving much background material other than that which appeared in the papers.

For 1947, no co-ordinated policy for C.C.L. unions had been established as yet. The unions' aims in general terms were full employment, expansion of purchasing power in the lower income brackets, and assistance in stalling off any chance of business recession before it starts.

Mr. Kidd closed with some general remarks regarding profits and distribution of the national income. He presented government statistics indicating that in 1942 45 percent of the workers earned less than $1,000 and received 16 percent of the national income; 82 percent earned less than $2,000 and obtained 50 percent of the national income; about 2 percent earned more than $5,000 and received 13 percent of the national income.

The speaker suggested the possibility of an over-production of capital goods and an under-production of consumer goods if present trends continue, and closed with the hope that no further test of strength will be necessary in union activities.

Over 100 branch members listened to Mr. Kidd's talk with great interest and a very lively discussion followed.

WINNIPEG BRANCH

R. T. Harland, M.E.I.C - - *Secretary-Treasury*

A joint general meeting of the Manitoba Association of Professional Engineers and the Winnipeg Branch of the Engineering Institute, held March 14 at the University of Manitoba, was addressed by F. L. Lawton, assistant chief engineer, Aluminum Company of Canada, Limited, Montreal, on the subject **The Economics of Water Diversion.**

Mr. Lawton drew attention to the invisible waterpower available in many parts of the world, and especially Canada, which can be developed by diverting water from one watershed to another. He noted that such waterpower is frequently overlooked by governmental agencies and the public generally, who commonly think waterpower is associated only with such visible sites as water falls and rapids.

He went on to state that experience in hydro-electric power development has amply demonstrated the parable of the buried talent. The time to develop waterpower, particularly a diversion, is as soon as possible. Every delay not only increases the cost of making the development, but also increases the interference occasioned by the claims of other parties that their rights are being invaded. If the delay is long enough, then due to the actual construction of private and public works which conflict with the plans of the development, the cost of materialization becomes so great that it is uneconomical to proceed and the opportunity to create the power is lost. On the other hand, if the job had been tackled earlier, the private and public works, instead of interfering, could have proceeded equally well and probably even more rapidly as one of the results of the power developed.

The address was illustrated with diagrammatic lantern slides and figures covering a wide range of diversion developments in Canada, the United States, Brazil, Germany, Norway and other countries the world over. The whole address seemed to emphasize the universal and international nature of the engineering art as applied to the development of hydro-electric power for man's use.

Some 50 engineers were in attendance at the meeting, and H. W. McLeod presided.

AN URGENT REQUEST

Would members who do not file the *Journal* kindly return their March 1947 copy to headquarters.

Due to difficulties at the printers, fewer copies have been printed than had been ordered and the needs of several libraries have not been filled.

Library Notes

BOOK REVIEW

PIEZO—ELECTRICITE; THEORIE ET PRATIQUE

Ed. Palmans. Editions Techniques P. H. Brans, Anvers; 1946 161 pp., illus., 150 Fr.

Reviewed by G. E. Sarault, m.e.i.c.*

This compact little book contains considerable information in its 150-odd pages. It is profusely illustrated by numerous well executed drawings and a few excellent photographs. A bibliography of 97 references is given to articles in European and American technical publications. It is divided in two parts: Part I—The physics viewpoint; Part II—The practical applications.

The first chapter is devoted to a study of crystal structures in general with special reference to characteristic symmetries and their reference to the piézo-electric properties. The resonance phenomenon in crystals is treated in the second chapter; various oscillation modes are considered, the most important "cuts" employed are described, and the frequency variation with respect to temperature is well covered. The usual equivalent electrical circuit is analyzed and formulas are derived for the L, R and C elements. The third chapter gives an interesting explanation of the piézo-electric effects based on the molecular structure of the crystals.

Chapter one of Part II covers the use of Rochelle salt crystals as electro-acoustic transformers. Pickups, microphones, cutters, phones are considered in turn; detailed information being given on principles of operation, construction, properties and characteristics. The 33 pages of chapter two are of primary interest to radio engineers, being devoted to applications of the resonance properties of crystals; impedance-frequency characteristics are derived from equivalent electrical circuits, frequency stability of a few oscillator circuits is considered and general notes are given on frequency measurements, quartz filters and ultra-sonic sounders.

The book is intended for the general technical reader who desires basic information on the subject; it should prove of considerable interest to all radio engineers or others interested in crystal applications, who have a reading knowledge of French.

ADDITIONS TO THE LIBRARY

TECHNICAL BOOKS

Applied Engineering Mechanics:
Alfred Jensen. N.Y., McGraw-Hill; Toronto, Embassy, 1947. 316 pp., illus., cloth.

Bibliography of Soil Science, Fertilizers and General Agronomy, 1940-1944:
Imperial Bureau of Soil Science, Harpenden, England, 1946. 567 pp., cloth.

City and Regional Planning Papers:
Alfred Bettman; edited by Arthur C. Comey. Cambridge, Harvard University Press, 1946. 294 pp., cloth.

Construction des Avions; 2d ed:
Guy Du Merle. Paris, Dunod, 1947. 855 pp., illus., paper.

Encyclopaedia Britannica; a New Survey of Universal Knowledge:
Chicago, Toronto, Encyclopædia Britannica, c1947. 24 volumes, cloth.

Engineering Problems Manual; 4th ed:
Forest C. Dana and Lawrence R. Hillyard. N.Y., London, McGraw-Hill; Toronto, Embassy, 1947. 419 pp., illus., cloth.

Ganaraska Watershed, a Report on:
A. H. Richardson. Toronto, King's Printer, 1944. 248 pp., illus., paper.

Introduction to Aerodynamics of a Compressible Fluid:
Hans Wolfgang Liepmann and Allen E. Puckett. N.Y., Wiley; London, Chapman & Hall, c1947. 262 pp., illus., cloth. (Calcit Aeronautical Series.)

Metal Working and Heat-Treatment Manual, Volume 2; Alloy Steels, Cast Iron and Non-Ferrous Metals:
F. Johnson. London, Paul Elek (1947). 226 pp., illus., cloth.

Consulting Engineer and Professor, Department of Electrical Engineering, Laval University, Quebec City, Que.

Book notes, Additions to the Library of The Engineering Institute, Reviews of New Books and Publications

Operation of Job Evaluation Plans; a Survey of Experience:
Helen Baker and John M. True. Princeton, Princeton University. Industrial Relations Section, 1947. 111 pp., paper.

Russian-English Technical and Chemical Dictionary:
Ludmilla Ognatiev Callaham. N.Y., Wiley; London, Chapman & Hall, c1947. 794 pp., cloth.

Sewage and Sewage Treatment; 6th ed:
Harold E. Babbitt. N.Y., Wiley; London, Chapman & Hall, c1947. 692 pp., illus., cloth.

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Kungl. Tekniska Hogskolans. Handlingar: (Royal Institute of Technology, Stockholm. Transactions.)
Nr 3, 1946—New Methods of Filter Design by Means of Frequency Transformations, Gosta Neovius.
...Nr 4, 1947—On Distillates from Wood, Nils Hellstrom.

Public Works Engineers' Yearbook—Directory, 1946:
Chicago, American Public Works Association, c1946.

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American Industries Series: *(Boston, Bellman Publishing Inc.)*
No. 4—Aluminum Industry, Stanley V. Malcuit.
...No. 5—Plastics Industry, Barrett L. Crandall.
...No. 6—Refrigeration Industry, David C. Choate.

Electrochemical Society. Preprints:
91-7—Chromic Acid Electrolyte for a Magnesium Primary Cell, H. A. Barbian and R. E. McNulty; 91-8—Combination Phosphorometer and Spectroradiometer for Luminescent Materials, Austin E. Hardy; 91-9—Electrolytic Valve Action of Zirconium, Walter R. Carmody; 91-10—Simple Derivation of the Limiting Current with the Dropping Mercury Electrode by Dimensional Analysis, Oscar Kanner; 91-11—New Ultraviolet Phosphors, Herman C. Froelich; 91-12—Acid Electric Steel for Castings, Sam F. Carter and C. K. Donoho; 91-13—Effect of Small Lead and Silver Additions on the Corrosion Resistance of Castings of Magnesium and Certain of its Alloys at Elevated Temperature and High Humidity, R. R. Rogers and W. Dingley; 91-14—Electric Steel in the United States at Forty-One, Clarence G. Merritt.

Harvard University. Graduate School of Engineering. Publications:
No. 424—Thin Cylindrical Antenna: a Comparison of Theories, David Middleton and Ronold King; No. 425—Stress Conditions for the Failure of Saturated Concrete and Rock, Karl Terzaghi; No. 426—Propagation of Waves in Orthotropic Media, G. F. Carrier; No. 427—Free-Fall Coring Tube: a New Type of Gravity Bottom Sampler, M. Juul Hvorslev and Henry C. Stetson.

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Contribution to the Solution of the Gas Turbine Problem, A. J. R. Lysholm.

Laboratoria N. V. Philips' Gloeilampenfabrieken Eindhoven (Holland). Separaat:
1682—Limits and Achievements of Modern X-Ray Tube Constructions, H. B. G. Casimir and W. J. Osoterkamp; 1683—New Method of Producing Asperical Optical Surfaces, H. Rinia and P. M. Van Alphen; 1690—Complete and Incomplete Crystals; 1692—Determination of Uranium with o-Oxyquinoline, A. Claassen and J. Visser; 1695—Colour Equations, P. L. Bouma; 1696—Textures of Straight-Rolled and of Cross-Rolled Molybdenum, J. F. H. Custera and J. C. Riemersma; 1698—Effective Permeability of Mixtures of Solids, D. Polder and J. H. Van Santen; 1699—Signal-Noise Ratio at V.H.F., M.J.O., Strutt and A. Van Der Ziel; 1703—Influence of Irradiation with Light on the Dielectric Properties of ZnS Phosphors, W. De Groot; 1691—Fundamental Principles of Frequency Modulation, Balth van der Pol; 1697—Combinatorial Problem, N. G. De Bruijn.

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Prevention of Moisture Damage to Cargoes in General Cargo Spaces, O. D. Colvin and S. J. Duly.

...Some Gear Cutting Inaccuracies and Their Effect on Gear Loads and Gear Noises, S. F. Dorey and F. H. Forsyth.

...Structural Investigations in Still Water on the Tanker "Newcombia", R. B. Shepheard and F. B. Bull.

...Various Types of Refrigerating Machinery for Ships, J. D. Farmer.

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...ASA Z10.12-1946—Letter Symbols for Chemical Engineering.

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...Standards:—*BS Handbook No. 2, 1946—British Standards for Workshop Practice; BS125, 1947—Hard-Drawn Copper Conductors for Overhead Transmission Purposes; BS1347, 1947—Architects', Engineers' and Surveyors' Boxwood Scales.*

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Gr. Britain. Ministry of Town and Country Planning. London, H.M.S.O., 1944.

International Air Transport; text of White Paper (Cmd 6561), 1944.

N.Y., British Information Services, 1944.

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E. D. Benton and R. B. Engdahl. (Reprinted from A.S.M.E. Transactions, January 1947.)

BOOK NOTES

Prepared by the Library of The Engineering Institute of Canada

The Institute does not assume responsibility for any statements made; these are taken from the preface or the text of the book.

INTRODUCTION TO PRODUCTION CONTROL:

D. Tiranti, with the collaboration of W. F. Walker. Chapman & Hall, London, 1946. 159 pp., illus., cloth, 15s.

This book is intended as an introduction to the subject of production control. The method and working of a production control system is explained in a practical manner, and the many charts and diagrams help to make clear the details involved.

The principal chapters in this book include: Relationship of Production Control to Factory Organization; Written Standard Practice; Forms; Charting; Pre-Production; Target Date; Time Cycle; Routing and Despatching; Detail Arrangements for Control and Progress of Work in the Shops.

RADIANT HEATING:

T. Napier Adlam. Industrial Press, N.Y., 1946. 472 pp., illus., cloth, $6.00.

Intended for engineers, contractors, architects, builders and others concerned with building heating and snow melting for walls, driveways or airports, "Radiant Heating" is primarily a working manual on the subjects.

Practical in its approach, this book covers information on theory of heat radiation, artificial heating as related to bodily heat losses, measurement of comfort, determining mean radiant temperature, temperature studies in radiant heated rooms, radiant heating with ceiling panels, radiant heating with floor panels, use of wall panels, metal panels, and electricity, air venting and flow adjusting, controls for radiant heating, areas and surface temperatures of radiant heat panels, determining panel type size, spacing and heat input, radiant cooling and air conditioning, snow melting by embedded pipes, etc.

Data resulting from the author's own tests on effect of floor coverings are also included. Formulas have been reduced to the simplest terms consistent with sufficient accuracy to meet practical requirements, and simple easy-to-use charts give most of the essential design data without calculation. Exact step-by-step procedure in designing and installing radiant heating systems is summarized.

Mr. Adlam, the author, is a recognized authority on radiant heating.

The following notes on new books appear here through the courtesy of the Engineering Societies Library of New York, and may be consulted at the Institute Library.

ATOMIC THEORY for Students of Metallurgy (Institute of Metals Monograph and Report Series No. 3).

W. Hume-Rothery. Institute of Metals, 4 Grosvenor Gardens, London, S.W.1, 1946. 286 pp., illus., diagrs., charts, tables, 8½ x 5½ in., cloth, 7s.6d.

This book was written primarily to provide the general background of atomic theory required for the effective understanding of the electron theory of metals. The first half of the book presents this necessary background on a thorough mathematical basis, while the second half develops the metallurgical aspects with emphasis on the properties of metals, conductivity, emission, magnetism, etc., for which the underlying theories provide a direct explanation. Intended for advanced students and research workers in metallurgy, much of the subject matter should also be of interest to chemists and physicists.

Bellman Publishing Company (American Industries Series):

No. 4. ALUMINUM INDUSTRY, *by S. V. Malcuit. 36 pp.*
No. 5. PLASTICS INDUSTRY, *by B. L. Crandall. 36 pp.*
No. 6. REFRIGERATION INDUSTRY, *by D. C. Choate. 32 pp.*

Bellman Publishing Company, 83 Newbury St., Boston, Mass., 1946. Illus., tables, 9 x 6 in., paper, $1.00 each.

Three of a series of pamphlets intended to present an over-all account of a large number of basic American industries, as well as information about the "jobs" that comprise these industries. The job information part provides material on personal qualifications and scholastic training needed, remuneration, chances for advancement, possibilities for both men and women in the industry, and a statement of advantages and disadvantages. A feature of each pamphlet is the analytical index of occupations in the particular industry, with brief descriptions farther along of the duties of the various jobs listed.

CITY and REGIONAL PLANNING PAPERS:

A. Bettman, edited by A. C. Comey. Harvard University Press, Cambridge, Mass., 1946. 294 pp., tables, 10 x 7 in., cloth, $4.50.

This book contains a selection of the published papers of a noted lawyer and city planning advocate. In Part I are collected a group of 24 important papers on various aspects of city and regional planning. Part II consists of two of the author's most important law briefs, relating to the constitutionality of zoning and to public housing. Part III presents two contributions in the presentation of model drafts for statutes. Part IV is a bibliography of Alfred Bettman's published writings on planning and housing from 1917 to 1945.

Le COBALT:

R. Perrault, preface by P. Chevenard. Dunod, Paris, 1946. 151 pp., illus., diagrs., charts, tables, 10 x 6½ in., paper, 390 frs.

This comprehensive work opens with a brief historical introduction concerning cobalt and its early uses. The following two sections describe the minerals containing cobalt and the location and nature of the important deposits. Processes for the concentration and extraction of cobalt are given, including the electrolytic method. Mechanical and chemical properties of cobalt are discussed, and a large section is devoted to a detailed survey of its applications, including uses of its oxides and salts. The final chapter gives briefly some production and consumption figures and various price quotations. *(Continued on page 248)*

PRELIMINARY NOTICE

of Applications for Admission and for Transfer

April 30th, 1947

The By-laws provide that the Council of the Institute shall approve, classify and elect candidates to membership and transfer from one grade of membership to a higher.

It is also provided that there shall be issued to all corporate members a list of the new applicants for admission and for transfer, containing a concise statement of the record of each applicant and the names of his references.

In order that the Council may determine justly the eligibility of each candidate, every member is asked to read carefully the list submitted herewith and to report promptly to the Secretary any facts which may affect the classification and selection of any of the candidates. In cases where the professional career of an applicant is known to any member, such member is specially invited to make a definite recommendation as to the proper classification of the candidate.*

If to your knowledge facts exist which are derogatory to the personal reputation of any applicant, they should be promptly communicated.

Communications relating to applicants are considered by the Council as strictly confidential.

The Council will consider the applications herein described at the June meeting.

L. Austin Wright, General Secretary

*The professional requirements are as follows:—

A **Member** shall have been engaged in some branch of engineering for at least six years, which period may include apprenticeship or pupilage in a qualified engineer's office or a term of instruction in a school of engineering recognized by the council. In every case a candidate for election shall have held a position of professionl responsibility for at least two years. The occupancy of a chair as professor, assistant professor, associate professor or lecturer in a faculty of applied science or engineering, shall be considered as professional responsibility.

Every candidate who has not graduated from a school of engineering recognized by the council shall be required to pass an examination as prescribed by council, on the theory and practice of engineering, with special reference to the branch of engineering in which he has been engaged.

A **Junior** shall have been engaged in some branch of engineering for at least four years. This period may be reduced to one year, if the candidate for election has graduated from a school of engineering recognized by the council, in which case he shall not remain in the class of Junior beyond the end of the eighth year after graduation.

Every candidate who has not passed the examinations of the third year in a school of engineering recognized by council shall be required to pass an examination in engineering science as prescribed by council. He shall not remain in the class of Junior beyond age thirty.

A Junior may be transferred to Member without payment of transfer fee providing he makes application before the end of the seventh year after graduation or, if a non-graduate, before attaining age twenty-nine, and his application is approved by council.

Council may extend the above limits if in its opinion special circumstances warrant such extension.

A **Student** shall be at least seventeen years of age, and shall present a certificate of having passed an examination equivalent to the final examination of a high school, or the matriculation of an arts or science course in a school of engineering recognized by the council or shall be required to write examinations as prescribed by the council.

He shall be:

a. pursuing a course of instruction in a school of engineering recognized by the council, in which case he shall be transferred to Junior automatically without payment of transfer fee in the second January after graduation, or

b. receiving a practical training in the profession in which case he shall be transferred to Junior without payment of transfer fee providing he makes application before attaining age twenty-five and his application is approved by council.

He shall not remain in the class of Student after he has attained the age of twenty-five, unless in the opinion of council special circumstances warrant the extension of this age limit.

An **Affiliate** shall be one who is not an engineer by profession but whose pursuits, scientific attainments or practial experience qualify him to co-operate with engineers in the advancement of professional knowledge.

The fact that candidates give the names of certain members as reference does not necessarily mean that their applications are endorsed by such members.

FOR ADMISSION

BELSHAW—FRANK, of Sarnia, Ont. Born at Brantford, Ont., Sept. 12, 1922. Educ.: B.A.Sc., (Mech.), Toronto, 1946; 1940-42, apprent., mech. engr., Waterous Ltd., Brantford, Ont.; 1943, (summer), jr. dftsman., Waterous Ltd.; 1944, (summer), dftsman., Goodyear Tire & Rubber Co., New Toronto; 1945, (summer), dftsman., Waterous Ltd., Brantford; 1946 to date, drfsman., Imperial Oil Limited, Sarnia, Ont.

References: C. P. Sturdee, W. A. Williams, M. L. Walker, R. L. Piper, R. Neave, G. L. Macpherson.

BLOCH-HANSEN—FELIX ALBIN LEOPOLD, of Hamilton, Ont. Born at Hillerod, Denmark, Jan. 24, 1898. Educ.: Technologish Institute, Denmark, 1919-20; 1920-21, testing and research of turbines, Atlas Turbine Mfg. Co., Copenhagen; 1922-26, chief engr., and mech. supt., complete charge of boiler turbines and machinery on ships, J. Lauritzen Gronningen, Copenhagen, Denmark; 1926-41, complete charge of bldg., boilers and all prod. machinery and new constrn., Canada and McCormick Biscuit Co.; 1941-45, Lieut. Engr., R.C.N.R.; 1946 to date, erection and modification of all brewing and bottling machinery incl. boilerhouse, refrigeration system and general service, supvr. of bldg., erection, sub-contracts work and purchase and instln. of all new machinery, Peller Brewing Co., Ltd., Hamilton, Ont.

References: E. R. Jarmain, E. V. Buchanan, G. Moes, B. R. Spencer, A. Love.

BOA—GILBERT STUART, of Toronto, Ont. Born at Montreal, Que., Aug. 8, 1924. Educ.: B.A.Sc., (Civil Engrg.), Toronto, 1946; 1943-44-45, (summers), rodman, C.N.R., constrn. dept.; instru'man., Dept. Highways, Ontario, surveys; instru'man., C.N.R., constrn. dept.; 1946 to date, jr. engr., design dept., Dominion Bridge Co., (Ontario branch), Toronto, Ont.

References: E. R. Graydon, R. F. Legget, T. Dembie, M. W. Huggins, J. J. Traill.

CANN—HARRY ALEXANDER, of Edmonton, Alta. Born at Chater, Man., May 25, 1914. Educ.: B.Sc., (Civil Engrg.), Manitoba, 1936; 1937, dftsman., Canadian Pacific Rly.; 1938-40, office & sales work, industrial sales divn., Dominion Rubber Co.; 1940-45, Lieut. and Capt., R.C.E.; 1945 to date, sales engr., industrial divn., Dominion Rubber Co., Edmonton, Alta.

References: P. L. Debney, E. H. Wright, P. J. Maggs, E. P. Fetherstonhaugh J. N. Finlayson, R. T. Hollies.

DIMOND—ARTHUR WILLIAM, 592 Homewood Ave., Niagara Falls, Ont. Born at Edmonton, Alta., Jan. 2, 1920. Educ.: B.Sc., (Chem. Engrg.), Alberta, 1942; 1940 (summer), asst. Bureau of Geology and Topography; with Consolidated Mining & Smelting, Trail, B.C., as follows: 1941, (summer), helper, 1942-43, plant tester; 1943, (6 mos.), chemical analyst, Imperial Oil Limited, St. Clair Processing, Sarnia, Ont.; 1943 to date, engr., research & special development of new products, improvement of processes, metallurgy of zinc, Burgess Battery Co., Niagara Falls, Ont.

References: I. F. Morrison, R. S. L. Wilson, J. W. Porteous, L. A. Thorssen, E. D'Appolonia.

DRYSDALE—ALPIN OGILVIE, 4050 Madison Ave., Montreal, Que. Born at Ottawa, Ont., Nov. 5, 1916. Educ.: B.Eng., (Mining) McGill; 1941; attended Royal Military Coll. of Science, England, 1943 (Field Artillery Equipt.); R.P.E., Quebec; 1937-40, (summers), student, Dome Mines Ltd.; student asst., Dominion Geological Survey; student, Omega Gold Mines Ltd.; 1941, (1 mo.), demonstrator, survey school, McGill Uuiv.; 1941, (5 mos.), plant engr., Canada Cement Co., Ltd.; 1941-46, Officer, Cdn. Army Overseas, rank of Major; R.C.E.M.E., O/C. 3 Cdn. Ing. Brigade Workshop, 1st Cdn. Army Troops Workshop, 4 Cdn. Armoured Troops Workshop; 1946 to date, asst. supt., Plant No. 1, Canada Cement Co., Ltd., Montreal, Que.

References: H. G. Thompson, J. G. Notman, W. F. Drysdale, F. B. Kilbourn, T. J. Kennedy, V. C. Hamilton.

GOW—PETER WILLIAMSON, 4617 Wilson Ave., Montreal, Que. Born at London, Eng., March 26, 1899. Educ.: Woolwich Polytechnic, 1914-1919; Royal Ordnance Factories, diploma, 1920; R.P.E., Quebec; 1914-1920, apprent., Royal Arsenal, Woolwich, Eng.; with Canadian Allis-Chalmers Ltd., Montreal, as follows: 1920-33, dftsman., 1933 to date, chief dftsman.

References: A. P. Benoit, W. H. Midgley, H. A. Van Patter, H. J. Roast, D. Giles, C. A. Robb, P. B. French, G. R. Pritchard.

McINERNEY—HAROLD OWEN, of Riverbend, Que. Born at Rexton, N.B., Dec. 25, 1895. Educ.: B.Sc., New Brunswick, 1920; 1914-19, C.E.F., active service, with rank of Capt.; 1912-19, (summers), student asst., Dept. Public Works, instru'man., Crown Land Survey, Prov. of N.B.; with Price Bros. & Co., as follows: 1920-22, asst. engr., mech. dept., Kenogami, Que.; 1922-34, buss millwright, mech. dept., Kenogami; 1934-41, master mechanic, mech. dept., Kenogami; 1941-44, Capt. R.C.O.C., overseas; 1945, Lt.-Col. O/C. No. 1 Group Shops, 1st Canadian Base Workshop, I/C all 4th Echelon Repairs Cdn. Army on A.F. V's., Heavy Vehicles, Armament, and Engrg. Equipt., R.C.E.M.E.; 1945 to date, asst. genl. supt., Price Bros. & Co., Riverbend, Que.

References: G. F. Layne, J. Stephens, A. Cunningham, E. O. Turner, C. H. Champion, E. Cowan.

SCAIFE—JAMES FINLEY, 41 Rosewarne Ave., St. Vital, Man. Born at Winnipeg, Man., Sept. 10, 1919. Educ.: B.Sc., (Civil Engrg.), 1942; 1939-42, (summers), inspectr. & lab. technician for Black Top concrete, etc., National Testing Labs.; 1943-46, Lieut., R.C.E.; at present, instru'man., highways branch, Dept. of Public Works, Manitoba.

References: G. H. Herriot, A. E. Macdonald, W. F. Riddell, E. P. Fetherstonhaugh, G. B. Williams.

SELLERS—ERNEST GEORGE, 109 Francis St., East, Fort William, Ont. Born at Port Arthur, Ont., May 8, 1915. Educ.: B.Sc., (E.ect. Engrg.), Queen's 1941; R.P.E., Ontario; 1933-40, mech. and elect. mtce., Federal Grain Co., Ltd., Fort William, Ont.; Phillips Electrical Works Ltd., Montreal, as follows: 1941-42, asst. to chief tester, testing of various types of elect. cables, 1942, impregnation and sheathing of paepr insulated cables; 1942-45, Dept. National Defence, Naval Service, as Lieut., and finally Elect. Lieut.; 1945 to date, asst. to mech. supt., engaged in mech. and elect. instalns. and mtce., Federal Grain Co., Ltd., Fort William, Ont.

References: F. W. R. Angus, W. H. Small, T. W. Brackinreid, O. W. Titus, N. T. Dann, J. P. Watts.

WOOD—LEONARD ROBERT, 452 Dundurn St., South, Hamilton, Ont. Born at Mimico, Ont., April 24, 1918. Educ.: B.A.Sc., (Metall. Engrg.), Toronto, 1941; 1937-40, (summers), chainman survey, Canadian National Rlys.; furnace operator, International Nickel, Sudbury, Ont.; asst. foreman, prod., Heywood & Wakefield, Orillia, Ont.; Defence Industries Ltd., Verdun, Que., as follows: 1941-42, foreman, process engrg. dept., 1942-45, suprv., process engrg. dept., i/c mfg. procedures and tool designs; 1945 to date, plant engr., Building Products Ltd., Hamilton, Ont.

References: L. J. Newton, J. G. Hall, E. A. Agnew, E. A. Allcut, C. R. Young.

WALKER—PAUL GORE WOOLHOUSE, of St. Thomas, Ont. Born at Wealdstone, Middlesex, Eng., Feb. 16, 1919. Educ.: B.A. (Engrg)., Christ's

College, Cambridge Univ., 1941; General Electric Co., Ltd., Wembley, Eng., as follows: 1936-37, dftsman. in genl. & designs drawing office, research lab., 1938, vacation student in mech. workshops; 1939, civil engrg. asst., F. H. Burnt, consultg. engr., London; Sir Alex. Gibb & Partners, London, as follows: 1939-40, civil engrg. dftsman., planning & designs office, 1940-41, personal asst. to chief planning engr., supvn. of main & sub-contractor's work, liaison officer with Ministry of Supply, checking & co-ord. of plans, etc., (in connection with constrn. of Royal Ordnance Factory, Risley, Lancs.), 1941, asst. civil engr. on over and underground surveys and supervn. of constrn. underground aircraft factory at Corsham, Wilts.; 1941-46, R.A.F. Pilot and Flying Instructor; 1946-47, in sole charge of surveys, preliminary information for factory sites nr. Wigan, Lancs., planning & design of above factories, Sir Alex. Gibb & Partners, London; at present, municipal engr., surveys, design of small structures, sewers, supvn. of contractors & administrative work, City of St. Thomas, Ont.

References: A. Gibb, W. C. Miller, A. L. Furanna, H. A. McKay, G. N. Scroggie.

ZOLKIEWICZ—ZYGMUNT JULIAN, 3634 Lorne Crescent, Montreal, Que. Born at Kalusz, Poland, May 22, 1907. Educ.: Engineer, (diplom.) Politechnika Lwowska, Lwow, Poland, 1936; (doctor's degree interrupted in 1939 due to war); R.P.E., Quebec (licensed); 1931-36, asst. to prof. Lwow Univ., (charge students projects and from 1933 all projects of national research, subject: strength of materials); 1935-37, designer and res. engr., office of consultg. engr., i/c concrete and steel design, structure (water supply); 1937-38, chief engr., Jaroslaw, Poland, i/c all public works; 1938-39, project engr., National Chemical Factory ,Moscice, Poland, i/c of project (new factories); 1941-44, concrete and steel designer, Aluminum Co. of Canada; 1944 to date, structl. designer, i/c design steel, concrete, wood, and subjects of strength of materials, engrg. dept., Canadian Industries Limited, Montreal, Que.

References: B. A. Evans, W. L. Pugh, S. R. Banks, D. G. Elliot, B. Szczeniowski, J. F. Fraser.

LIBRARY NOTES *(Continued from page 246)*

COSMIC RADIATION, Fifteen Lectures:

Edited by W. Heisenberg, translated by T. H. Johnson. Dover Publications, New York, 1946. 192 pp., illus., diagrs., charts, tables, 9½ x 6 in., cloth, $3.50.

The fifteen lectures collected in this book were presented in Germany in 1941 and 1942. They are broadly grouped as follows: an introductory review of the present state of knowledge of cosmic radiation; two papers on the cascade theory; nine papers dealing with mesons; two papers on nuclear particles; and one paper on geomagnetic effects. Although the work of several authors, the material is well integrated, with cross-references and a consistent notation. A general view is given of recent accomplishments and outstanding problems in this branch of physics. There is a general index.

FUNDAMENTALS of INDUSTRIAL ELECTRONIC CIRCUITS:

W. Richter. McGraw-Hill Book Co., New York and London; Embassy, Toronto, 1947. 569 pp., illus., diagrs., charts, tables, 9¼ x 6 in., cloth, $4.50.

Striking a middle course between the popular treatment and the exhaustive treatise, this book aims to show the fundamental principles applying to circuits containing vacuum tubes. These circuits are reduced to a combination of more familiar circuit elements so that the average electrical engineer and practical man can analyze the performance of the circuits and can design them himself. Illustrative sketches, circuit diagrams, and practical problems effectively supplement the text material.

INTRODUCTION TO AERODYNAMICS OF A COMPRESSIBLE FLUID (Ga cit Aeronautical Series):

H. W. Liepman and A. E. Puckett. John Wiley & Sons, New York; Chapman & Hall, London, 1947. 262 pp., illus., diagrs., charts, tables, 9¼ x 5¾ in., cloth. $4.00.

The material presented in this book is designed to furnish the reader with a background of fundamentals in this increasingly important subject to enable him to understand and systematize observed compressibility effects and to approach the more mathematical literature of the subject. The first part of the book stresses basic phenomena under simple geometrical conditions, with a discussion of elementary one-dimensional gas dynamics. Part II takes up the more difficult subject of general two and three-dimensional equations and some of the approximate methods of solving them.

MATRIX and TENSOR CALCULUS with applications to Mechanics, Elasticity and Aeronautics (Galcit Aeronautical Series):

A. D. Michal. John Wiley & Sons, New York; Chapman & Hall, London, 1947. 132 pp., diagrs., tables, 9¼ x 6 in., cloth, $3.00.

Matrix calculus and tensor calculus are dealt with separately in the two parts of this book. The minimum of mathematical concepts is presented in the introduction to each part, with the more advanced mathematical ideas being developed as needed in connection with the material on applications. Although the emphasis is on aeronautical and mechanical applications, such as vibrations, aircraft flutter, elasticity, hydrodynamics, and fluid mechanics, the purpose is to provide a working knowledge of use in many technical fields.

PANEL HEATING and COOLING ANALYSIS:

B. F. Faber and F. W. Hutchinson. John Wiley & Sons, New York; Chapman & Hall, London, 1947. 208 pp., diagrs., charts, tables, 8¾ x 5½ in., cloth, $4.20 (in Canada).

The first four chapters of this new book present non-technical, descriptive material on the background, development, advantages, disadvantages, and types of installations of panel heating and cooling systems. The second and largest section, Chapters V to XI, contains a detailed and rigorous treatment of the theory of radiant exchange and the mathematical analysis of panel systems. The last two chapters discuss simplified design procedure and the concept of "equivalent conductance". It should be noted that the design procedure, as developed, is applicable to all system types whether energized by hot water, steam, warm air, or electricity.

PRINCIPLES AND PRACTICE OF SURVEYING, Vol. 2. Higher Surveying:

C. B. Breed and G. L. Hesmer. 6 ed. John Wiley & Sons, New York; Chapman & Hall, London, 1947. 674 pp., illus., diagrs., charts, tables, 7½ x 4½ in., cloth, $5.40 (in Canada).

The five sections of this standard work have been generally revised to conform to current practice. Topics covered are as follows: Part I, Survey control, astronomical observations, leveling practice; Part II, Topographical surveying by the stadia method and by the plane-table method, with discussion of the relation of geology to topography; Part III, Ground, aerial, and stereo-photogrammetry; Part IV, Hydrographic surveying and stream gaging; Part V, Constructing and finishing maps. Effectively illustrated, the volume also contains some 30 pages of tabular data in addition to that included with the text. Methods for the adjustment of triangulations and level circuits are appended.

RESISTANCE OF MATERIALS:

F. B. Seely. 3 ed., John Wiley & Sons, New York; Chapman & Hall, London, 1947. 486 pp., illus., diagrs., charts, tables, 8½ x 5½ in., cloth, $4.00.

Part I of this standard text is concerned with the generalized basic aspects of the subject; the main problem being the determination of the relationships between the loads acting on a member and the resulting stresses and deformations in the member. Part II deals with more specialized topics such as particular kinds of stresses or structural members which may be dealt with independently. The emphasis throughout is on the engineering significance of the subject, with consideration given to altered conditions resulting from recent technological developments.

ROADWAY AND TRACK:

W. F. Rench. Simmons-Boardman Publishing Corp., New York, 1946. 350 pp., illus., diagrs., tables, 9¼ x 6 in., cloth, $5.00.

Modern methods of roadway and track maintenance are described and illustrated in the new edition of this standard practical handbook. While the utilization of mechanical equipment is featured, methods in use where such equipment is not available are also covered. Part III on special problems and duties includes the economics of track labour, safety precautions, and the investigation of train accidents.

TABLES OF SPHERICAL BESSEL FUNCTIONS, Vol. 1:

Prepared by the Mathematical Tables Project, National Bureau of Standards. Columbia University Press, New York, 1947. 375 pp., tables, 10¾ x 8 in., cloth, $7.50.

In the theoretical analysis of wave motion, solutions of various coordinate systems are necessary, and in certain ones Bessel functions are involved having orders equal to one-half an odd integer. The present volume provides tables to seven or more significant figures for the spherical Bessel functions of orders $\pm(n+1/2)$ where $n=0$ to 13 with an interval of 1, and for a range of X from 0 to 10 with intervals of .01 and from 10 to 25 with .1 intervals. The customary detailed explanatory introduction is included, and a list of the previous publications of the series is appended.

UNIONIZATION OF PROFESSIONAL ENGINEERS AND CHEMISTS:

H. R. Northrup. Industrial Relations Counselors, New York, 1946. 52 pp., 9¼ x 6 in., paper, $1.50. (Industrial Relations Monograph No. 12.)

No. 12 of this series of studies examines the union movement among engineers and chemists of professional status. Existing unions, the reasons for unionization, the attitude of the professional societies, Labour Relations Board decisions, and collective bargaining activities are discussed in a brief, factual manner.

Employment Service

The service is operated for the benefit of members of The Engineering Institute of Canada, and for industrial and other organizations employing technically trained men—without charge to either party. It would therefore be particularly appreciated if employers would make the fullest possible use of these facilities to make known their existing or estimated requirements. Notices appearing in the Situations Wanted column will be discontinued after three insertions, and will be re-inserted upon request after a lapse of one month.

Situations Vacant

CHEMICAL

CHEMICAL ENGINEER, required by a chemical firm in Shawinigan Falls, Quebec, for development work on plastics. Salary open. Apply to File No. 3812-V.

CIVIL

CIVIL ENGINEERS with some experience on design and field work required by a public utility in Toronto. Salary open. Apply to File No. 3813-V.

CIVIL ENGINEER, age 35-40, with considerable experience in design of structures, water supply, sewers, required by an organization in Montreal. Salary $300-$400. Apply to File No. 3820-V.

JUNIOR CIVIL ENGINEER, required by a firm of contractors in Montreal, for general duties in connection with construction. Salary according to experience. Apply to File No. 3822-V.

CIVIL ENGINEER required to act as superintendent and assistant to general contractor in Shawinigan Falls. Must be bilingual. Salary $300-$400 Apply to File No. 3827-V.

JUNIOR CIVIL ENGINEER, required in the Province of Quebec for the locating of roads and highways. Salary $250 up plus expenses. Apply to File No. 3830-V.

ELECTRICAL

ELECTRICAL ENGINEER with experience in layout and design of generating and transformer stations, required by a public utility in Toronto. Salary open. Apply to File No. 3813-V.

ELECTRICAL ENGINEER required by a manufacturer in Western Canada to be in charge of production. Preferably between 30 and 40 years with desire to earn or buy interest in the business. Salary $4,000 up. Apply to File No. 3815-V.

JUNIOR ELECTRICAL ENGINEER required by a Montreal firm for inspection of electrical equipment of all kinds, in Toronto area. Salary $225. Apply to File No. 3816-V.

ELECTRICAL DESIGNING DRAUGHTSMAN with broad practical experience and theoretical knowledge required for a firm in Quebec. Salary from $225. Apply to File No. 3818-V.

ELECTRICAL ENGINEER, recent graduate up, preferably with experience in audio circuits design and maintenance also practical knowledge of fractional horsepower motors and wiring layouts, required to eventually take charge of sound maintenance for motion picture studio in Ontario. Salary open. Apply to File No. 3826-V.

MECHANICAL

JUNIOR MECHANICAL ENGINEERS, required by a Montreal manufacturer of machines and equipment for mechanical type of work such as machine design, etc. Salary $175 up. Apply to File No. 3664-V.

MECHANICAL ENGINEERS, with experience in plant layout and design or ventilation problems or general mechanical design, required by a firm in Quebec. Salary from $250. Apply to File No. 3818-V.

MECHANICAL ENGINEER, age 35-40, with considerable experience in design and layout of machinery and equipment, required by an organization in Montreal. Salary $300-$400. Apply to File No. 3820-V.

MECHANICAL ENGINEERS, preferably with experience in machine design, required by a steel fabricating firm in Montreal for design and layout. Salary open. Apply to File No. 3824-V.

MECHANICAL ENGINEER with considerable experience, required to supervise installation of coating machine also design necessary, tankage and piping systems, for a paper mill in Ontario. Salary around $400. Apply to File No. 3828-V.

MECHANICAL ENGINEERS, required by a pulp and paper mill in Ontario for design and layout also mechanical installations. Salary around $300. Apply to File No. 3828-V.

JUNIOR MECHANICAL ENGINEER with sales experience and good knowledge of Montreal, required for sale of power house equipment. Preferably bilingual. Salary $200-$250. Apply to File No. 3831-V.

MECHANICAL ENGINEER, required by a manufacturer in Ontario for the plant operation staff. Salary open. Apply to File No. 3833-V.

MECHANICAL ENGINEER with six to ten years experience in maintenance and engineering work, required by alkali manufacturers in Ontario. Salary open. Apply to File No. 3833-V.

MINING

MINING ENGINEERS, with varied experience required by a firm in Quebec for general mine operation, exploitation and development work. Salary from $250. Apply to File No. 3818-V.

MISCELLANEOUS

BRIDGE ENGINEER, qualified to be in charge of the design and supervision of the construction of highway bridges. Apply stating qualifications, experience, age and salary wanted to File No. 3780-V.

STEAM PLANT ENGINEER for large concern in Eastern Townships, with at least 5 years practical experience. Must be familiar with thermo-dynamics, combustion control, steam turbines, mechanical refrigeration, hydraulics, etc. Permanent position and attractive salary for the right man. Apply to File No. 3791-V.

CHIEF ENGINEER required for coal stripping and mining operations in Alberta, would also have responsibilities in highway construction in this Province. Minimum salary $6,000. Apply to File No. 3814-V.

ASSISTANT GENERAL MANAGER to be in charge of all coal development operations in Alberta and some highway contracts. Salary $8,000 to $10,000. Apply to File No. 3814-V.

INDUSTRIAL ENGINEER with broad experience in plant development, operation, costs and management required for a firm in Quebec. Salary from $250. Apply to File No. 3818-V.

GRADUATE ENGINEER, preferably with chemical and industrial experience, required to supervise operations at the Sodium Sulphate Plant now being constructed at Chaplin, Sask. Salary open. Apply to File No. 3821-V.

DRAUGHTSMEN required by a pulp and paper mill in the Eastern Townships for general draughting and detailing. Three or four years experience preferred but not essential. Salary open. Apply to File No. 3823-V.

CAPABLE JUNIOR ENGINEER, required to represent Canadian manufacturer in France. Must be fluently bilingual. Salary open. Apply to File No. 3825-V.

DRAUGHTSMAN, preferably with mechanical background, required by a manufacturer in Montreal for design work on electrical equipment. Salary open. Apply to File No. 3829-V.

SALES ENGINEER, preferably with sales experience, required by an oil company in Montreal for sales engineering of industrial oils and greases in Eastern Ontario. Considerable travelling. Salary open. Apply to File No. 3832-V.

DEPUTY DIRECTOR OF IRRIGATION, Ceylon, must be Corporate Member of the Institute of Civil Engineers or possess degrees or diplomas recognized by that body. Technical duties include designing, estimating for and reporting on schemes of irrigation water supply and flood protection and checking the construction costs of such schemes. Apply to File No. 3834-V.

The following advertisements are reprinted from last month's Journal, having not yet been filled.

CHEMICAL

CHEMICAL ENGINEER OR CHEMIST, preferably with Ph.D., required by a pulp and paper company with plants in Eastern Canada, for research work. Salary open. Apply to File No. 3549-V.

CHEMICAL ENGINEER required by a pulp and paper company with plants in Eastern Canada, for mill control and pilot plant work. Salary open. Apply to File No. 3549-V.

CHEMICAL ENGINEER required by a petroleum refining company in Montreal for process and design work. Salary about $225. Apply to File No. 3575-V.

CHEMICAL ENGINEER required as assistant professor of chemical engineering in a Canadian university to start autumn 1947. Salary open. Apply to File No. 3600-V (D).

CHEMICAL ENGINEERS OR CHEMISTS for analytical work in the laboratory of an industrial firm in Central Ontario. Salary from $175. Veteran preferred. Apply to File No. 3642-V.

CHEMICAL ENGINEER. preferably with sales experience, for sales and service with an industrial firm in Central Ontario. Salary open. Apply to File No. 3642-V.

CHEMICAL ENGINEERS, both with experience and recent graduates, required by an industrial organization in the St. Maurice Valley. Salary open. Apply to File No. 3644-V.

CHEMICAL ENGINEER recent graduate up, to be assistant to the department superintendent of a tar distillery in the Toronto area. Salary $225. Apply to File No. 3674-V.

CHEMICAL OR METALLURGICAL ENGINEERS, from recent graduates up, required by a Quebec firm engaged in metal production for employment as production and development engineers. Salaries open. Apply to File No. 3693-V.

JUNIOR CHEMICAL ENGINEER required for the control department of a paper mill in Shawinigan Falls. Salary from $175-$275. Apply to File No. 3765-V.

CHEMICAL ENGINEER OR CHEMIST interested in textile dyeing, required by an industrial firm in South Western Quebec. Salary open. Apply to File No. 3798-V.

CHEMICAL ENGINEER, with pulp and paper experience, required by a firm of consulting engineers in Montreal, for design and research. Salary according to experience. Apply to File No. 3799-V.

CHEMICAL ENGINEER with knowledge of how to treat sulphate or failing this sulphite and soda pulp, required as Regional Manager by a large paper company in Northern Ontario. Executive and management ability necessary. Permanent position. Salary $15,000. Apply to File No. 3808-V.

CIVIL

CIVIL ENGINEER with experience in the mechanical trades required as designer by a building contractor in Quebec, age 30-35, salary open. Apply to File No. 3444-V.

CIVIL ENGINEER to take charge of work in a drainage district in Quebec. Must be bilingual. May be recent graduate. Salary from $200. Apply to File No. 3479-V.

CIVIL ENGINEER for design work in an industrial plant in the Montreal area with experience in building construction, probably permanent position, salary from $200 up according to experience. Apply File No. 3504-V.

CIVIL ENGINEERS with experience in detailing and designing structural steel and reinforced concrete for manufacturers are required for a steel fabricating company in Manitoba. Salary open. Apply File No. 3519-V.

CIVIL ENGINEERS, recent graduate up, required by a pulp and paper company with plants in Eastern Canada. Salary open. Apply to File No. 3549-V.

CIVIL ENGINEER, age 35-40, with extensive experience in detailing and checking structural steel in buildings and bridges, required by a steel fabricating company in Southern Ontario. Salary open. Apply to File No. 3570-V.

CIVIL ENGINEER, senior designer, experienced in reinforced concrete and structural steel and general building construction, required to take charge of structuraldesign staff for a firm of consulting engineers in Montreal. Salary $300-$400. Apply to File No. 3585-V.

CIVIL ENGINEERS with master's degree, teaching and consulting experience, age 28-40, required for the staff of a university in N.Y. State. Salary open. Apply to File No. 3600-V (C).

CIVIL ENGINEER, preferably with railroad experience, required by a company engaged in large scale asbestos production in Quebec to supervise construction of local railroad. Salary open. Apply to File No. 3683-V.

CIVIL ENGINEER, recent graduate up, required for government organization on West Coast, to carry out field surveys, investigations of water resources and their application and to make reports, maps, plans, etc. Salary $200 up. Apply to File No. 3724-V.

CIVIL ENGINEER, with at least five years' experience, to be assistant to the Director of Community Planning of the Province of Saskatchewan. Starting salary $200-$250. Apply to File No. 3746-V.

CIVIL ENGINEER with experience in survey and construction, preferably bilingual, required to take charge of the engineering department for the woods operations of a paper company in Eastern Quebec. House available. Salary $350 up. Apply to File No. 3749-V.

CIVIL ENGINEER, qualified O.L.S., required as town engineer and superintendent of works for a town in Central Ontario. State age and salary desired. Apply to File No. 3750-V.

GRADUATE CIVIL ENGINEER, required by a public utility in the Montreal area with three or four years' experience in design of reinforced concrete and structural steel. Salary $250-$300. Apply to File No. 3766-V.

GRADUATE CIVIL ENGINEER, required as structural designing engineer by a firm engaged in the manufacture of cranes, crushers, pumps, etc., in the Toronto area. Preferably with 5 to 10 years' experience in designing and detailing steel buildings and bridges. Salary open. Apply to File No. 3771-V.

CIVIL ENGINEER is required to act as Town Engineer and take complete charge of the engineering service of a town in Ontario. Maximum salary $3,000. per annum. Apply to File No. 3782-V.

GRADUATE CIVIL ENGINEER required by an industrial corporation in Montreal for design work in draughting room. Must be familiar with structural steel and concrete design. Position offers good opportunity and permanency to right man. Salary from $250 up according to experience. Apply to File No. 3785-V.

SEVERAL CIVIL ENGINEERS, with two or three years' experience in road construction required for road building work in Northern Quebec. Salary open. Apply to File No. 3804-V.

ELECTRICAL

ELECTRICAL ENGINEER, age 32-36, with electrical experience around mines or smelters. English speaking with working knowledge of French, is required by a company in Shawinigan Falls, Quebec. Salary open. Apply to File No. 3415-V.

ELECTRICAL ENGINEER age 30 - 45 with sales training with large manufacturer of electrical equipment instruments and 5-10 years experience as sales service and sales engineer required as sales engineer in Canada for U.S. firm making special equipment for transport and industry. Salary open. Apply to File No. 3447-V.

ELECTRICAL ENGINEER, recent graduate, required for the engineering staff of a paper mill in the Lake St. John area. Salary open. Apply to File No. 3507-V.

ELECTRICAL ENGINEERS, from recent graduates up, required by a company in Montreal engaged in the production of telephone, etc., equipment Veterans preferred. Salary open. Apply to File No. 3551-V.

ELECTRICAL ENGINEER with knowledge of power apparatus, preferably bilingual, required for sales work with a manufacturer in the Montreal area. Salary open. Apply to File No. 3646-V.

ELECTRICAL ENGINEER with considerable industrial experience required as a safety engineer by a public utility in the Montreal area. Bilingual preferred. Salary open. Apply to File No. 3654-V.

ELECTRICAL ENGINEER with several years experience required as a designer by an industrial organization in Montreal. Salary open. Apply to File No. 3677-V.

ELECTRICAL ENGINEER, with general knowledge of a.c. and d.c. motors, switchgear, mercury rectifiers, transformers and other electrical apparatus, for sales work in Eastern Canada, age 30 to 35, salary open. Apply to File No. 3695-V.

ELECTRICAL DRAUGHTSMAN with several years' experience in industrial layouts for large concern in Eastern Townships. Permanent position and attractive salary available for experienced men. Apply to File No. 3701-V.

ELECTRICAL ENGINEER, age about 30, with considerable experience, required by a manufacturer in the St. Maurice Valley. Salary open. Apply to File No. 3723-V.

ELECTRICAL ENGINEER, with at least five years experience on overhead and underground transmission and distribution systems. Required as distribution engineer by a public utility in Brazil. Salary open. Apply to File No. 3738-V.

ELECTRICAL DESIGNING DRAUGHTSMAN with considerable industrial experience and initiative required by an electrical firm in Montreal. Salary open. Apply to File No. 3751-V.

ELECTRICAL ENGINEER with estimating and contract experience, required as office engineer by an electrical firm in Montreal. Salary open. Apply to File No. 3751-V.

ELECTRICAL ENGINEER, recent graduate up, required by a manufacturer in Montreal, for sales engineering. Preferably bilingual and familiar with rotating electrical equipment. Salary $200. up. Apply to File No. 3761-V.

GRADUATE ELECTRICAL ENGINEER with 5 or more years experience in electrical equipment of buildings, required by a consulting engineer in Montreal. Salary open. Apply to File No. 3773-V.

GRADUATE ELECTRICAL ENGINEER with at least three years experience, preferably construction required by a manufacturer in Central Ontario, to supervise electrical installations on construction jobs. Salary open. Apply to File No. 3775-V.

GRADUATE ELECTRICAL ENGINEERS with 3 to 10 years experience in design, operation, layout of substations, switching stations, and electrical machinery, together with engineering studies, including draughting for a large hydro electric power house in Quebec. Salary $225 up. Apply to File No. 3787-V.

GRADUATE ELECTRICAL ENGINEER, required to train as Sales Engineer with National organization. Permanent position. Must be prepared to be stationed in Alberta or Saskatchewan. Reply giving full particulars. Enclose photo when answering. Apply to File No. 3790-V.

ELECTRICAL ENGINEER required for power sales by an electrical utility in Province of Quebec. Preferably experienced. Bilingual. Salary open. Apply to File No. 3802-V.

MECHANICAL

MECHANICAL ENGINEER, is required for draughting and detail work with a company in central Ontario. Good prospects for advancement. Single man preferred. Salary open. Apply to File No. 3393-V.

MECHANICAL ENGINEERS, preferably with design experience, are required for armament research and development in the Quebec area, in a government establishment. Salary from $190. Apply to File No. 3401-V.

MECHANICAL ENGINEER with experience in pulp and paper or mining work required by a pulp and paper company with plants in Eastern Canada. Salary open. Apply to File No. 3549-V.

MECHANICAL ENGINEER from recent graduates up, preferably with paper and pulp experience, required by a firm in the St. Maurice Valley. Salary according to experience. Apply to File No. 3573-V.

MECHANICAL ENGINEERS to be design squad leaders on heavy machinery design required by a company in Central Ontario. Salary open. Apply to File No. 3623-V.

MECHANICAL ENGINEER recent graduate, required by an industrial firm in south western Quebec, for the design and erection of complex textile machinery. Salary open. Permanent position. Apply to File No. 3625-V.

MECHANICAL ENGINEER with experience in the fabrication of Farm Implements, required by a Quebec firm. Bilingual man preferred. Salary according to experience. Apply to File No. 3666-V.

MECHANICAL ENGINEER with experience in the design of industrial machinery required by a Montreal firm manufacturing custom built machines. Salary $200-$250. Apply to File No. 3669-V.

MECHANICAL ENGINEER with design experience in the pulp and paper industry required by a firm with headquarters in Montreal. Salary $350. Apply to File No. 3673-V.

JUNIOR MECHANICAL ENGINEER with knowledge of precision machine shop practice and aptitude for research work in metals and plastics required for an organization in Toronto for the production of artificial limbs. Must be veteran. Salary from $225. Apply to File No. 3675-V.

MECHANICAL ENGINEER with industrial or construction experience, required by a firm of consulting engineers to inspect machinery deliveries in the Cornwall area. Salary open. Apply to File No. 3691-V.

MECHANICAL ENGINEER, recent graduate up, required for maintenance and production engineering by an industrial firm in Montreal. Salary open. Apply to File No. 3692-V.

MECHANICAL ENGINEERS, age 25-35, required by a manufacturer in Montreal, for training as sales engineers and for executive positions. Salary from $200. Apply to File No. 3710-V.

JUNIOR MECHANICAL ENGINEER, under 30 and preferably bilingual, required by a Montreal firm to train as sales engineer for pumps, engines and allied electrical equipment. Salary open. Apply to File No. 3714-V.

MECHANICAL ENGINEER, under 45, with at least ten years' experience in design of heating, ventilating and refrigeration layouts, required as heating engineer for a government organization on West Coast. Salary $250-300. Apply to File No. 3724-V.

YOUNG MECHANICAL ENGINEERS, with practical experience either in automotive or general manufacturing industries, together with ability to operate engineering office systems, required by an industrial organization in Ontario. Salary open. Apply to File No. 3732-V.

MECHANICAL ENGINEERS, with at least five years' experience in the Pulp and Paper industry required by an Ontario Paper Company. Salary open. Apply to File No. 3733-V.

JUNIOR MECHANICAL ENGINEER with industrial experience required as assistant to the plant engineer in a factory in the Montreal area. Salary about $225. Apply to File No. 3758-V.

GRADUATE MECHANICAL ENGINEER, experienced in boiler operation, required as assistant superintendent on maintenance of railroad and tramways rolling stock, in the Quebec area. Salary $200. per month. Apply to File No. 3772-V.

MECHANICAL ENGINEER with 5 or more years experience in heating. ventilating and air-conditioning, required by a consulting engineer in Montreal. Salary open. Apply to File No. 3773-V.

MECHANICAL ENGINEER, with paper mill or mining experience required for design and layout by a paper mill in Northern Quebec. Salary $375-400. Apply to File No. 3778-V.

MECHANICAL ENGINEER with considerable experience willing to act as assistant to Mechanical Superintendent of a textile manufacturing concern near Montreal. Salary open. Apply to File No. 3784.-V

MECHANICAL ENGINEER, recent graduate up, required by a Pulp and Paper Company in the Province of Quebec for work entirely centred in logging operations. Salary open. Apply to File No. 3789-V.

MECHANICAL ENGINEER, recent graduate up, required by major oil company in Montreal area. Salary $175 up according to experience. Apply to File No. 3792-V.

MECHANICAL ENGINEERS required by a Pulp and Paper mill at Powell River, B.C. Preferably with experience in plant design in the pulp and paper industry. Salary according to qualifications. Apply to File No. 3796-V.

MECHANICAL ENGINEER required to establish and operate an estimating and planning department for the grinding and machine shop of a firm located in Central Ontario. Experience in tools, dies, and shop work essential. Salary open. Apply to File No. 3801-V.

MECHANICAL DRAUGHTSMAN, with several years experience in machine design, required by an industrial organization in Montreal. Salary $250 up. Apply to File No. 3807-V.

MECHANICAL ENGINEER with at least 10 years experience in design and installation of machinery also supervisory ability required by an industrial organization in Montreal, Salary open. Apply to File No. 3807-V.

MINING

MINING ENGINEER with several years experience required by a company engaged in large scale asbestos production in Quebec. Salary open. Apply to File No. 3683-V.

MISCELLANEOUS

MANAGEMENT ENGINEER with business administration and mechanical background, age 30 up, bilingual with at least 5 years practical experience, required by an industrial engineering consultant in Montreal. Apply to File No. 3307-V.

CIVIL OR MECHANICAL ENGINEER with experience in pulp and paper mills, to be assistant to plant engineer in a paper mill in Central Quebec. Salary open. Apply to File No. 3445-V.

TWO STRUCTURAL STEEL DRAUGHTSMEN with five or more years experience in designing and detailing steel structures. State experience and salary required. Location Toronto. Apply to File No. 3451-V.

STRUCTURAL STEEL DRAUGHTSMEN AND CHECKERS, preferably graduate engineers but any experienced men acceptable, are required for a steel fabricating company in Manitoba. Salary open. Apply to File No. 3519-V.

ASSISTANT PLANT ENGINEER with paper mill experience required by a pulp and paper company with plants in Eastern Canada. Salary open. Apply to File No. 3549-V.

GRADUATE ENGINEERS with experience in air-conditioning, heating, refrigeration and allied problems, required by a manufacturer in the Montreal area. Salary open. Apply to File No. 3566-V.

DESIGN ENGINEER with considerable experience required by a pulp and paper firm in the St. Maurice Valley. Salary open. Apply to File No. 3573-V.

GRADUATE ENGINEERS, required by a large industrial and chemical organization with headquarters in Montreal for all phases of research design, operation, development, production and maintenance. Salaries open. Apply to File No. 3588-V.

ASSISTANT PROFESSORS AND INSTRUCTORS required for the staff of a technical college in New York State. Salary open. Apply to File No. 3600-V. (A)

DESIGN ENGINEERS with experience in reinforced concrete and hydraulic structures for hydro-electric developments for an engineering firm with headquarters in Toronto. Salary open. Apply to File No. 3612-V.

CHIEF ENGINEER with industrial experience required for a steel fabricating plant in Western Canada. Salary open. Apply to File No. 3616-V.

STRUCTURAL AND MECHANICAL DRAUGHTSMAN required for detail drawings by a steel fabricating plant in Western Canada. Salary open. Apply to File No. 3616-V.

DESIGN DRAUGHTSMAN for the design of cranes and hoists of all types, capable of making and checking complete manufacturing detail drawing, required by a manufacturer in Southern Ontario. Apply to File No. 3628-V by letter with full details. Salary open.

SALES ENGINEER with wide engineering experience wanted by a company in Toronto for the sale of textile machinery and construction equipment. Salary open. Apply to File No. 3639-V.

MECHANICAL AND STRUCTURAL DESIGNERS AND DRAUGHTSMEN required by a pulp and paper company in the Port Arthur district. Salary open. Apply to File No. 3653-V.

ASSISTANT ENGINEER with experience in estimates and specifications for industrial work required by a pulp and paper company in the Port Arthur district. Salary open. Apply to File No. 3653-V.

CHIEF DRAUGHTSMAN with at least five years draughting room and related engineering office experience, preferably in pulp and paper or process industries, required by a pulp and paper mill in the Port Arthur district. Salary open. Apply to File No. 3653-V.

CIVIL OR MECHANICAL ENGINEER, required by a pulp and paper company in Newfoundland to look after new development work and general engineering in connection with woods operations. Salary open. Apply to File No. 3655-V.

ASSISTANT PLANT ENGINEER, preferably with pulp and paper or structural design experience, required for a newsprint mill in a city on north shore of Lake Superior. Salary open. Apply to File No. 3657-V.

MECHANICAL OR ELECTRICAL ENGINEERS for training as production engineers with an industrial firm in Montreal. Salary open. Apply to File No. 3662-V.

GRADUATE ENGINEERS for mechanical design, experimental, test and development departments of a Canadian firm producing aircraft gas turbines. Salary open. Apply to File No. 3667-V.

STRUCTURAL DESIGNERS AND DRAUGHTSMEN required by a firm of consulting engineers in Montreal. Salary open. Apply to File No. 3668-V.

JUNIOR ENGINEERS, recent graduates up, as designing draughtsmen for a brewing company with headquarters in Montreal. Salary from $200. Apply to File No. 3670-V.

JUNIOR ENGINEER, recent graduate up, required as surveyor by a company engaged in large scale asbestos production in Quebec. Salary open. Apply to File No. 3683-V.

CIVIL OR MECHANICAL ENGINEERS with design or structural experience required by a manufacturer of contractors' equipment in the Hamilton area. Salary open. Apply to File No. 3698-V.

JUNIOR ENGINEERS, recent graduate up, required for the engineering staff of a communications company with headquarters in Montreal. Veterans preferred. Salary from $175. Apply to File No. 3713-V.

JUNIOR STRUCTURAL DESIGN ENGINEER required by a steel fabricating firm in Central Ontario. Salary open. Apply to File No. 3715-V.

JUNIOR ENGINEERS, recent graduates up, with mechanical background required by a Montreal manufacturer for the design and supervision of boiler plant installations, preferably bilingual. May have sales work. Salary from $200. Apply to File No. 3722-V.

MINING AND METALLURGICAL ENGINEER, age about 30, with considerable experience, required by a manufacturer in the St. Maurice Valley. Salary open. Apply to File No. 3723-V.

CONSTRUCTION ENGINEER with considerable experience required for the permanent staff of a Montreal inspection company. Salary about $200. Age immaterial. Apply to File No. 3728-V

DETAILER AND DESIGNER for reinforcing steel with considerable experience required by a steel fabricating firm in Montreal. Salary open. Apply to File No. 3740-V.

STRUCTURAL STEEL DETAILER AND CHECKER with considerable experience required for checking shop details by a steel fabricating firm in Montreal. Salary open. Apply to File No. 3740-V.

DESIGN ENGINEERS, age about 30, with experience in the design and layout of chemical plants, required by an industrial organization in the St. Maurice Valley. Salary from $250. Apply to File No. 3741-V.

DESIGN DRAUGHTSMEN, age about 25, with experience in chemical plant layouts, required by an industrial organization in the St. Maurice Valley. Salary from $200. Apply to File No. 3741-V.

SALES ENGINEER required in the St. John, N.B., district by a firm handling oil purifiers, piston rings and allied engineering products. Salary $250. plus commission. Apply to File No. 3744-V.

SALES ENGINEER, preferably bilingual, required by a Montreal firm dealing in building materials. Salary from $200. Apply to File No. 3745-V.

GRADUATE ENGINEERS, recent graduates up, preferably mechanical, required for the engineering and operating staff of a pulp mill in Eastern Quebec. Salary open. Apply to File No. 3748-V.

PUBLICITY ENGINEER required by an electrical firm in Montreal to organize publicity department and edit trade journal. Salary open. Apply to File No. 3751-V.

GRADUATE ENGINEER, under 40, with industrial and manufacturing experience and some knowledge of sales, required by a bolt and nut manufacturer in the Montreal area. Salary open. Apply to File No. 3752-V.

GRADUATE ENGINEER required by an insurance company in Montreal for the inspection of boilers, steam plant and allied equipment. Salary from $200. Apply to File No. 3754-V.

TECHNICAL GRADUATE, preferably Mechanical, Chemical or Electrical, under 30, veteran preferred, for permanent position with engineering organization. Training period in U.S. Work will include travelling for consultation among leading industrial plants. Enclose photo when answering. Salary open. Apply to File No. 3759-V.

CHIEF DRAUGHTSMAN with experience in Pulp and Paper Mill design wanted immediately in Port Arthur. Reply stating education, experience. Salary open. Apply to File No. 3760-V.

CIVIL, MECHANICAL OR CHEMICAL ENGINEERS, recent graduates up, preferably with experience in petroleum and heavy industry such as chemical or paper, required by an oil company in Toronto. Salary open. Apply to File No. 3762-V.

GRADUATE ENGINEER, with practical experience, production and maintenance, to take charge of Farm Equipment Factory with Grey Iron Foundry, located in Ontario. Apply with photo or snapshot to File No. 3764-V. Salary open.

GRADUATE ELECTRICAL OR MECHANICAL ENGINEER, must have thorough knowledge of fractional H.P. Motors required by a Montreal firm to take charge of small engineering department. Salary $350-$500. Apply to File No. 3770-V.

STRUCTURAL STEEL DRAUGHTSMAN, qualified to detail and check all classes of structural steel and to supervise draughtsmen in a large drawing office on the West Coast. Salary open. Apply to File No. 3777-V.

DESIGN ENGINEER to make investigations and preliminary drawings of cost estimates of alterations to buildings and machinery for a large paper mill in the St. Maurice Valley. Salary around $300. Apply to File No. 3779-V.

MECHANICAL OR ELECTRICAL ENGINEER, age 25-35, required as field service engineer, to handle technical refrigeration service and maintain liaison with national distributors, dealers and service organizations, in the Provinces of Canada, for an American firm. Salary $300-350. Enclose photo when answering. Apply to File No. 3781-V.

GRADUATE CIVIL OR MECHANICAL ENGINEERS with 3 to 10 years experience in design, cost estimates, draughting, and engineering studies for a large hydro-electric power house in Quebec. Salary $225 up. Apply to File No. 3787-V.

SALES ENGINEER with electrical engineering background in public utility or industrial field required by wire and cable manufacturer for engineering contact work in Ontario. Salary open. Apply to File No. 3788-V giving complete details.

GRADUATE, with some knowledge of looms, weave construction and cloth analysis, required as manager for rayon weaving plant in Peru. Administrative ability necessary. Knowledge of Spanish would be an advantage although not a necessity. Salary open. Apply to File No. 3794-V.

INDUSTRIAL ENGINEER, with two to five years experience in time-study and job evaluation required by a firm in Montreal making rock metal. Salary $200 up. Apply to File No. 3800-V.

GRADUATE CIVIL OR MINING ENGINEER required to take charge of several small instrument parties, for layout work in New Brunswick area. Salary $350. Apply to File No. 3803-V.

MECHANICAL AND ELECTRICAL ENGINEER required by a consulting engineer in Montreal for service engineering. Preferably with design experience in heating and ventilating. Salary $225 up. Apply to File No. 3805-V.

CHEMICAL OR MECHANICAL ENGINEERS, recent graduates, required by an organization in the Montreal area, for experimental and development work, with view to supervisory positions in production. Salary $200 up. Apply to File No. 3806-V.

ENGINEERING DRAUGHTSMEN, required by large transport company in Montreal for work leading to design. Salary $200 to start. Apply to File No. 3809-V.

BRIDGE INSPECTOR required by a large transport company in Montreal area. Salary open. Apply to File No. 3809-V.

RECENT GRADUATES OR JUNIOR ENGINEERS with mechanical background, required by a Montreal Engineering, fabricating and contracting firm for training purposes leading to sales and service. Area Montreal. Salary $175 up. Apply to File No. 3810-V.

STRUCTURAL ENGINEER, required by a firm of consulting engineers in Montreal for design work. Must have experience in structural steel and reinforced concrete. Salary open. Apply to File No. 3811-V.

University of Manitoba Requires Engineering Instructors

The Faculty of Engineering and Architecture of the University of Manitoba will require additional instructors for teaching duties beginning with the session 1947-1948. Applicants should be Engineering graduates from recognized Universities. The grades required will be assistant professors, lecturers and demonstrators in Civil Engineering and Mechanical Engineering. Salaries will depend on experience and general qualifications.

Apply as soon as possible to Dean of Engineering and Architecture, University of Manitoba, Winnipeg.

McGILL UNIVERSITY

Chemical Engineering teacher, unit operations and thermodynamics, salary $2,500 to $3,800, depending on qualifications. Apply to Department of Chemical Engineering, McGill University, Montreal 2, Canada.

Situations Wanted

MECHANICAL ENGINEER, M.E.I.C., P.E. Ont., 10 years' experience chemical industry of Ontario. Wishes to locate in West. Apply to File No. 1309-W.

GRADUATE ELECTRICAL ENGINEER, McGill, Jr. E.I.C., P. Eng. (Que.), whose eleven years' experience lie in the fields of specification writing for and supervision of small contract jobs, fire prevention and safety work in heavy and light industry, desires position in production-management line. Recent personal evaluation by prominent firm of Management Consultants in Montreal disclosed high general ability and aptitude for production work. Willing to consider any location in Canada. Age 35. Apply to File No. 1494-W.

YOUNG CIVIL ENGINEER, M.E.I.C., would accept some work at night at home. Preparation of estimates and tenders. At present employed on construction work. Apply to File No. 2128-W.

CIVIL ENGINEER, B.A.Sc., M.E.I.C., P. Eng., ex-R.C.E. Officer with several years experience in municipal, highway and hydraulic engineering. Presently employed but interested in position with municipality or firm where extensive construction and maintenance work is contemplated. Apply to File No. 2463-W.

HYDRAULIC ENGINEER, B.Sc., M.E.I.C., 20 years experience in Hydraulics relative to hydro-electric power development, hydraulic machinery design and manufacture and development in hydraulic turbine design. Experience in handling men. Desires change in position. Apply to File No. 2638-W.

CIVIL ENGINEER, M.E.I.C., Registered Professional Civil Engineer of Ontario, Resident Engineer on large unit price projects plus wide general experience. Available on short notice. Apply to File No. 2651-W.

ELECTRICAL-MECHANICAL ENGINEER, Jr.E.I.C., age 30, graduate of Naval Electrical Engineering Officers course at Nova Scotia Technical College, 1945. Graduate of Naval Electrical Artificer's course at University of Alberta, followed by 6 months of instructional work on same. One year at sea as Chief Electrical Artificer on frigate, in charge of all electrical equipment. Completed apprenticeship as machinest in railway repair shops in design work testing, research and calculations. Available on two weeks notice. Apply to File No. 2693-W.

MECHANICAL ENGINEER, S.E.I.C., P.E.Q., Jun. A.S.M.E., McGill 1946. Age 22. Single. Experience in methods engineering, tool design, heating and ventilating. Would prefer position with an established firm with a machine shop in order to gain shop experience. Suitable position anywhere in Canada acceptable. Available on short notice. Apply to File No. 2707-W.

RECENT GRADUATE ENGINEER—(Civil, electrical, mechanical) B.Sc., S.E.I.C., would accept sales work during spare time, anywhere in Province of Quebec. Apply to File No. 2814-W.

YOUNG MECHANICAL ENGINEER, B.A.Sc. Toronto, S.E.I.C., single, now engaged in product design and development with firm in the Maritimes, would prefer similar work in Southern Ontario requiring more technical and also some artistic ability. Apply to File No. 2818-W.

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THE ENGINEERING JOURNAL

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"To facilitate the acquirement and interchange of professional knowledge among its members, to promote their professional interests, to encourage original research, to develop and maintain high standards in the engineering profession and to enhance the usefulness of the profession to the public."

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COVER PICTURE

All technical papers in this issue relate to the National Research Council Atomic Energy Project at Chalk River, Ont., and were presented at the Diamond Jubilee Meeting of the Institute recently held in Toronto.

The cover picture is one of the first over-all views of the plant to be reclassified from the secret list.

THE DEVELOPMENT AND CONTROL OF ATOMIC ENERGY

GENERAL THE HON. A. G. L. McNAUGHTON, P.C., C.H., C.B., C.M.G., D.S.O., M.E.I.C.
President and Chairman, Canadian Atomic Energy Control Board

An address delivered at the Sixty-first Annual General and Professional Meeting of The Engineering Institute of Canada at Toronto, May 8th, 1947

General McNaughton traces the early developments in research which led to the splitting of the atom. Canada's share in the programme initiated in 1940 for making an atom bomb is told in detail. Steps taken to safeguard our uranium resources are enumerated. The research being carried out at Chalk river for peacetime uses of nuclear energy is discussed.

Steps taken toward international control since VJ day are listed. The American and Soviet plans for control are briefly explained and reasons why most nations favor the former are given. The United Nations Atomic Energy Commission's ffort s to date in attempting to bridge the gap between these two plans are described.

I count it a great privilege to be able to attend the Diamond Jubilee meeting of The Engineering Institute of Canada, and particularly today to have the pleasure of speaking to you briefly on some aspects of a subject which quite literally has burst on the attention of the world with a suddenness and with a violence the like of which has heretofore never even been imagined.

It is now not yet two years since atomic bombs were dropped on the cities of Hiroshima and Nagasaki. The consequence directly attributable to this action was the surrender of the Japanese Empire within a matter of hours, and thus ended the military operations of World War II. The first major use of atomic energy will therefore always be associated in our minds with a proper ending to a terrific long-enduring world-wide ordeal, in which our very existence was in hazard, and in which our conceptions of right and justice and the principles of our way of life had been sustained against the evil which the Axis autocracies had sought to impose on the world. This first use to end a tyranny and to restore peace is for us, and for those who think with us, a good augury into the future as to what the application of atomic energy may mean to the peaceful progress of the world and to the happiness and welfare of men of good will everywhere.

The evidence shows clearly that the possibilities for beneficial peaceful uses of atomic energy are very substantial. The larger industrial uses will naturally require time for development. It is therefore not to be expected that there will be any sudden revolution in the electrical power industry, for example. It seems to be the consensus of opinion of those best informed that the application of atomic power in special circumstances may come within a decade, and that large scale substitutions of atomic energy for coal derived power may require several decades.

Already some important applications are being made in the fields of medicine, of chemistry and of biology, by the use of minute quantities of the radioactive isotopes as tracers in the various processes being studied. Other substances in this category, for example, have been used as catalysts, to promote desired reactions in the cracking of oil and in the production of new plastics. One well known chemist has observed that the use of radioactive catalysts usually resulted in a nasty, sticky mess! This only goes to show, however, that we have yet a lot to learn about how to handle them.

When we come to consider the use of somewhat larger quantities, it has been proved that from a few pounds of the vital source materials, uranium and thorium, energy may be released in amounts capable (if it can be properly used) of heating or lighting a large city for months on end. These possibilities for the special and the larger uses of atomic energy lie in the realm of engineering. Each new idea that may evolve will need the most thorough enquiry and prompt analysis.

I think, therefore, we are fortunate in the decision taken by the President and Council of our Engineering Institute, that this jubilee meeting should be devoted to a study of atomic energy. It is imperative that we as engineers should become fully acquainted with the subject, with all its ramifications, from the location of the minerals in the ground, their mining and extraction, their separation, purification and reduction to metal, to their use in reactors. This is not only on account of the power which may be made available, but also because of the new products of great interest; perhaps also for the effective multiplication of the very materials from which the reactions releasing atomic energy have been started.

At our sessions this afternoon we are to hear addresses by three of the engineers who have been closely associated with the Canadian atomic energy programme. I propose, therefore, to confine my remarks to a brief review of the part Canada has taken in the field of nuclear physics, and to a discussion of some of the national and international aspects of the very acute and far-reaching problems which have been presented for solution.

Chronology of Nuclear Research

Canada has been associated with scientific development in nuclear physics ever since Lord Rutherford began his investigations on radioactivity at McGill University in 1899. In Canada as in other countries research dealing with the fundamental constitution of matter was largely the concern of the Physics Departments of the Colleges and Universities engaged in pure research. It was concerned with driving back the frontiers of human knowledge rather than with any so called "practical" application of the knowledge thus gained.

The theoretical equivalents of mass and energy had come to be accepted during the first decade of this century. For a long time it seemed that this transformation could only be realized on a minute scale. It was not until 1939, with the discovery in Germany that under certain conditions the atom of a particular isotope of uranium would split into two equal parts, that this matter began to assume practical implications. This split, or 'fission', as it came to be called, was accompanied by an enormous release of energy; and the even more spectacular idea was advanced that the process might be made to propagate itself as a "chain" reaction.

Calculations made at the time showed that a ilogram of uranium undergoing fission might release 1 one form or another energy equivalent to perhaps ome 20,000 tons of T.N.T. Thus the possibility pened up of a new weapon of war of fantastic power elative to anything which had previously been used.

Shortly after these discoveries were made, World Var II broke out. The possibility of producing a ecisive weapon based on the principle of fission in chain reaction became of immense importance to ll governments. If this could be done, obviously that ation which succeeded first might well gain thereby he power to eliminate all its enemies. The enormous otential value of the result was quickly recognized y the war leaders of all countries. Nowhere was this nore so than in the United States, where support rew in crescendo on a tremendous scale, in a careully planned and directed programme of mass effort hat swept all obstacles before it.

Never has there been any comparable undertaking r achievement in research and development in vorld history. We can rightly claim for scientists rom the United Kingdom, from Canada and from lsewhere in the British Commonwealth a share in he inception of these undertakings in the evolution f the scientific basis on which progress was made. We can claim a share too in the working out of the ictual methods which were used. But we must pay our generous tribute primarily to the United States, or without their effective participation in production, not even the best ideas could have been transated into accomplishment.

In 1940 information on atomic energy, as well as n other war research projects, was exchanged by the United Kingdom, the United States and Canada. In 1942 a laboratory was established at the University of Montreal, under the direction of the National Research Council, for the further investigation of the atomic energy problem. The staff for this laboratory was recruited not only from among scientists from Britain and Canada, but also from experts in nuclear physics from allied countries the world over. Research in this laboratory was closely co-ordinated with that which was taking place in Britain and the United States. Contributions of value were made to many phases of the joint undertaking.

Canada's Share in the Atom Bomb

In 1943 it seemed that a new way to manufacture and separate a fissionable material for use in a bomb should be studied on a pilot plant scale. Available facilities in the United States were fully taken up in existing research programmes and in production. In the United Kingdom it did not seem wise to attempt to build even a pilot plant, which would be exposed to the hazards of interference or destruction by reason of aircraft or V-bomb attack.

In consequence, Canada undertook the execution of this project. The design was developed in the Montreal laboratories. The plant itself was built at Chalk River, Ontario, where ample supplies of pure water were available from the Ottawa river. This very novel task was executed by a Canadian Company, "Defence Industries Limited", with Canadian engineers, Canadian workmen and Canadian management. I would like here to pay tribute to their magnificent achievement which I can say, as the President of our Canadian Atomic Energy Control Board, has met with the satisfaction of everyone concerned in the further operation of the plant.

This plant was approaching completion on schedule when war ended. We found ourselves in the very fortunate position of having in existence facilities on a scale commensurate with the carrying forward of research in atomic energy. Yet these facilities were not so large nor so expensive to operate as would make their continued use prohibitive in peacetime.

Besides carrying out the research work referred to, in the Montreal laboratories, and elsewhere in the National Research Council in Ottawa, in the laboratories of our Mines Branch and in our universities throughout the country, Canada contributed many men to the scientific work in projects in the United States and in the United Kingdom.

Another important contribution made by Canada to the atomic energy project was in the supply of uranium. This is the only substance which occurs in nature capable of releasing atomic energy, and usable as a starting point for the preparation of other fissionable materials with explosive properties.

Canada's Uranium Resources

At the Eldorado Mine on Great Bear Lake in the Northwest Territories, Canada possesses extensive deposits of pitchblende. This is one of the ores of uranium which had been worked in pre-war years for their radium content. In this important substance Canada had ranked as one of the world's two most important producers.

The whole process of radium production had been carried out in Canada from the mining at Great Bear Lake to refining at Port Hope on Lake Ontario, with final testing and measurement at Ottawa. The processes from beginning to end were developed by Canadian scientists in the National Research Council and in the Mines Branch. I feel that this is a useful example to show the value of national research. Here, when necessity called, we had not only the vital materials but also the most complete knowledge of the processes through which they had to be put. I believe that this knowledge of refining procedures and other related matters was perhaps as important to the allied cause as the possession of substantial amounts of the material itelf. Further, it is perhaps not generally known that metallic uranium was made in the National Research Council in Ottawa in 1938.

The mine at Great Bear Lake, closed in 1940 because of the war and because of the restricted requirements for radium, was re-opened in 1942 to secure adequate supplies of uranium oxide, which had previously been a by-product of little application. I may say that the minimum of publicity was sought, and that later in 1944, when it became clear that this project should be operated as a government enterprise, the ownership both of the mine and of the refinery was taken over by the Dominion Government.

Thus as a consequence of our war effort in the field of atomic energy, Canada attained a position in development which, while not of the same order of magnitude as that of the United States, was nevertheless second only to that country. Canada has considerable reserves of uranium. She has a staff of scientists—not nearly as many as we would like—who have wide experience in carrying out nuclear research. At Chalk River we have excellent facilities for further research which are being developed to acquire new knowledge, to train other scientists, and for the carrying forward of the particular investigations required to expedite the peaceful application of atomic energy in our own country.

Research on Peacetime Uses

Research on the peacetime applications of atomic energy, even when carried out on a comparatively small scale, is a very costly business. However, judging by what has been said in Parliament and in the press, it seems evident that Canadians fully realize the importance of such research, and are determined that it should be adequately supported. At its last session Parliament established the Atomic Energy Control Board, and assigned to it the duty of controlling and supervising future developments and applications of atomic energy in the interests of the people of Canada. Full responsibility for all phases of this problem has been vested in the Board.

After careful investigation and consideration, the Board decided that research at Chalk River could best be carried out under the auspices of the National Research Council. It therefore requested the Council to undertake the operation of that plant on its behalf. The Board has also made plans to encourage Canadian Universities to continue fundamental research in nuclear physics and its application in the fields of chemistry, medicine, etc. At the present time McGill University, the University of British Columbia and the University of Saskatchewan are planning extensive researches in this field. These plans have been reviewed with the National Research Council, and the Board has now been authorized by the Rt. Hon. C. D. Howe, Minister of Reconstruction and Supply, and Chairman of the Committee of the Privy Council on Scientific and Industrial Research, to announce that, subject to confirmation by Parliament, the Board will assist their work by financial grants for the purchase of special equipment.

To McGill University, which has already erected a new laboratory in which a 100 million electron volt cyclotron is being constructed, the Board plans to grant the sum of $87,500. Under the Board's proposals the University of British Columbia will receive $32,500 to assist in the provision of a Van de Graaf Generator and a Linear Accelerator to be used in the University's nuclear research programme. The Board proposes also that the University of Saskatchewan will receive $30,000 towards the purchase of a 20 million electron volt betatron. Such equipment is not available at Chalk River, so these Universities will be put in a position to undertake important research studies which cannot now be carried out elsewhere in Canada.

Peacetime Controls and Censorship

Canadian research, I would emphasize, is being devoted to the acquisition of fundamental knowledge in nuclear physics and towards the peacetime applications of atomic energy. However, the successful use of the atomic bomb during the war has shown that the Board cannot ignore the possible dangers to our national security resulting from non-peaceful applications. Consequently, when the wartime controls over substances useful in the production of atomic bombs expired last month, the Board issued regulations controlling dealings in these substances to ensure that they did not fall into improper hands. For similar reasons of national security the Board has also imposed restrictions on the publication of information on some aspects of this new science.

In these few remarks I have summarized the purely Canadian developments in the field of atomic energy. I would now like to call your attention to some of the international developments in this subject since the war.

Steps Toward International Control

Since 1945 the principal nations of the world have all established national organizations of one kind or another to plan and supervise research on the industrial applications of nuclear energy. In their planning, the nations of the world dare not lose sight of the fact that mankind has in the atomic bomb a means of destruction which is in a totally different category of power from anything previously known. The terrible destructive effects of the bomb as shown by the ruins of Hiroshima and of Nagasaki, and by the sunken and radioactive warships at Bikini, have caused thinking men in all parts of the world to realize that the use of atomic bombs in a future war might well prove disastrous for the survival of civilization. Efforts have therefore been made to bring about an international agreement for the control of this new kind of energy to ensure that it will never again be used for destructive purposes. In this worthwhile humanitarian purpose I am happy to claim that the leaders of Canada have had an important part.

The first international step towards the creation of such a programme was made very shortly after the termination of the war by the United States, Great Britain and Canada, the three countries which were associated in the wartime project. The Washington declaration on atomic energy issued on November 15, 1945, by President Truman, Prime Minister Attlee and Prime Minister King recognized the need for an international agreement and proposed as a matter of great urgency the setting up of a Commission under the United Nations to study the problem and to make recommendations for its control.

These discussions were followed by a meeting of the Foreign Ministers in Moscow in December, 1945, at which the Washington proposals were endorsed. At the meeting of the General Assembly on 24 January, 1946, in London, the United Nations Atomic Energy Commission was established by unanimous resolution.

The Commission, composed of delegates from each country represented on the Security Council, as well as Canada when Canada is not a member of the Council, was charged with making specific proposals:

(a) For extending between all nations an exchange of basic scientific information on peaceful ends,
(b) For the control of atomic energy to the extent necessary to ensure its use only for peaceful purposes,
(c) For the elimination from national armaments of atomic weapons and of all other major weapons adaptable to mass destruction,
(d) For effective safeguards by way of inspection and other means to protect complying states against the hazards of violations and evasions.

Two Alternative Plans for International Control

When the Commission first met in New York in June, 1946, it was presented with two different plans for the control of atomic energy, one proposed by the United States and the other by the Soviet Union. The United States proposal generally resembled that outlined in the Lilienthal Report, which had been

eleased in the United States a few months pre-
'iously. It called for the formation of an International Atomic Development Authority, which would oster beneficial uses of atomic energy and would :ontrol atomic activities in all nations either by lirect ownership, management or supervision, in the :ase of activities potentially dangerous to world ecurity, or by a licensing and inspection system n the case of other activities. This system of con-rol would be set up by stages and after it was in operation, the manufacture of atomic bombs would stop. Existing bombs would be disposed of, and he world authority would be given information regarding the production of atomic energy. In addition, he United States proposal emphasized that the veto of the Great Powers in the Security Council should not apply in the event that any nation was charged with having violated the international agreement not to develop or use atomic energy for destructive purposes.

I may say that the proposals made by the United States accord very closely with the views of the Government of Canada, and of many other nations in the Western World, as to how this problem might be brought under control. On the other hand, the Soviet Government put forward a plan which differed fundamentally. It proposed the immediate outlawing of the atomic bombs and the destruction of all existing stocks of atomic weapons within a three months period. To this end the Soviet delegate tabled a draft convention which, he said, should be negotiated forthwith as the step towards the establishment of a system of international control. The Soviet delegate was prepared to discuss methods of control and inspection but he maintained that this should not hold up the immediate prohibition of atom bombs.

Majority Favor American Proposal

The idea that the menace to world peace presented by the atomic bomb could be solved merely by the signing of an international agreement to prohibit its use or manufacture seems very unreal. The experiences of the last twenty-five years have shown that international agreements alone are not enough to safeguard the peace. The prohibition of the use and manufacture of the atomic bomb at the present time would merely seriously reduce the military strength of the United States, the only nation now in possession of atomic bombs. This would give no assurance that any country engaged in atomic energy activities would not or could not make and use the bomb in the future. Fissionable material, the essential material for such peaceful applications of atomic energy as the development of industrial power, is also the explosive element of the bomb, and could readily be diverted from peaceful to military uses by a nation secretly preparing for atomic war.

For this reason, most members of the Commission were in general agreement with the principles of the American proposals. They considered that the prohibition of the use or manufacture of the atomic bomb should form part of an overall control plan, so that when such prohibitions were put into effect they would be accompanied by the applications of safeguards such as international inspection of all countries to ensure that no secret activities in atomic energy were in progress.

Effective Control Technologically Feasible

After weeks of discussion along these lines, the Commission decided to seek a new approach to the problem by a study, in committee, of the available scientific information, to determine whether an effective control of atomic energy was feasible. This study resulted in a unanimous report by the scientists of all nations represented on the Commission that " they did not find any basis in the available scientific facts for supposing that effective control is not technologically feasible." With this conclusion before it, the Commission then proceeded to discuss the safeguards that would be required at each stage in the production and application of atomic energy to ensure its use only for peaceful purposes.

The Commission's findings were set out in detail in its first Report which was approved on December 31, 1946, by a vote of 10 to 0, with the Soviet and Polish Delegations abstaining. In this Report, the Commission pointed out that as all applications of atomic energy depended on uranium and thorium, control of these materials was an essential safeguard. The Commission, therefore, recommended international inspection of all mines, mills and refineries to prevent possible diversion of materials to the making of atomic bombs. As the materials assumed a more concentrated form and were therefore more directly applicable to bomb making, the Commission believed that the controls would have to be even stricter. They considered that at least certain plants producing substantial quantities of fissionable material should be placed under the exclusive operation and management of the international authority.

Minimum Powers of International Authority Being Considered

The Commission is now giving consideration to the minimum powers such an international authority would require in order to exercise effective control of atomic energy. This is a very important matter, for in the operation of any such control it is evident that there must be undue interference with the economic and political life of any country. However, I believe that the interests of all nations in the maintenance of peace so far transcends any other purpose or interest that they will eventually come to accept such limitations to their national sovereignty as are shown to be really essential for the effective control of atomic energy.

Progress in this direction may be slow, but I am hopeful that a proper agreement between nations may eventually be reached. This would not only make a great contribution towards the peace of the world. It would also make unnecessary the secrecy now imposed on new developments of atomic energy. It would thus permit all nations of the world to share in the benefits to be derived from its peaceful applications.

ENGINEERING NUCLEONICS

K. F. TUPPER
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A paper presented at the Sixty-first Annual General and Professional Meeting of The Engineering Institute of Canada, May 8th, 1947, at Toronto, Ont.

Pointing out that nuclear energy will gradually pass from the hands of the physicist to those of the engineer, the author draws the attention of the latter to the need for becoming familiar with the subject. Beginning with the concept of the atom, definitions are given of isotopes, shielding, radioactivity, fission, elements of the "pile", the "cross section", plutonium reaction and fission products. Radioisotopes are described, as well as the need for isotope separation. Two atomic fuels, uranium and thorium, are defined and compared.

Today it seems that nuclear energy may become an important supplement to the sources which man can control and use. It is extremely difficult to assess the importance. The possibilities are staggering in their immensity, but the technical difficulties and limitations are only slightly less immense.

Nuclear energy is still in the hands of the physicist. The aid of the engineer is needed by the physicist, and recent accomplishments can be said to have been co-operative achievements. In a years few, however, nuclear energy will have passed largely into the hands of the engineer, If the generation of power from nuclear energy is to be accomplished on an economic basis, the final phases of the undertaking will fall solely into the hands of the engineer. As engineers it behooves us to commence becoming familiar with the subject.

It is the purpose of this paper to present to you some of the concepts of nuclear physics which will be essential to a better understanding of the two companion papers published in this issue of the *Journal*. Reference should be made to an earlier paper① presented before the Institute and also to the Smyth report② which presents most of the available information on atomic energy in a form easily assimilated by the engineer. The present paper is given from the engineering point of view and there is no claim to scientific rigour.

Concept of the Atom

The atom consists of a nucleus surrounded by a cloud of electrons. Almost all of the mass of the atom is in the nucleus, the electrons possessing only about 1/40th of 1 per cent. The electrons travel in orbits about the nucleus much in the same manner that planets in the solar system travel about the sun. They are arranged in groups at various distances from the nucleus in an orderly fashion. Figure 1 presents a simplified picture of a helium atom. Electrons are particles having one unit of negative electric charge. They have small mass, about 1/1840th the mass of a nuclear particle. The nucleus is an aggregation of heavy particles. These nuclear particles are of two kinds, called protons and neutrons. Neutrons have no electric charge, whereas protons have each a single unit of positive charge.

The number of protons for any atom in a neutral state is exactly equal to the number of electrons in the electron cloud. This number is called the atomic number. It is the difference in atomic number which distinguishes one element from another. The atomic numbers for the natural elements run in sequence from unity to hydrogen to 92 for uranium. Nature apparently neglected to provide us with samples of elements of atomic numbers 43 and 61. The sum of the number of neutrons and the number of protons, that is, the total number of nuclear particles, is called the atomic mass number. The diameter of an atom is approximately 10^{-8} cm. The nucleus is very much smaller, having a diameter of about 10^{-12} cm. in the case of the largest nuclei.

Isotopes

Atoms of the same atomic number but differing in mass number are called isotopes. All isotopes of one element have the same number of protons in their nuclei but have different numbers of neutrons. For example, the nuclei of all carbon atoms have six protons, but they may have six, seven or eight neutrons (the nuclei with eight neutrons are unstable). Some elements have many natural isotopes. Tin has ten isotopes with mass numbers from 112 to 124. Other elements occur in nature with only a single isotope—aluminum, manganese, and gold are examples.

Physicists, with the aid of cyclotrons and other devices, are able to create many isotopes which do not occur in nature, and most of these are radioactive. This creation of new isotopes is accomplished by bombarding the nucleus with high speed particles. Various things may happen, In some cases the nucleus will capture the projectile and thus becomes a heavier nucleus. In other cases the projectile will knock out a particle or several particles and the nucleus will become lighter. In still other cases the particle will exchange places with a particle of different kind.

The number of neutrons in a nucleus is as great or greater than the number of protons. At the light end of the table of elements the numbers are approximately equal, but as the elements get heavier the number of neutrons begins to exceed the number of protons. At the end of the table the ratio of neutrons to protons is about 3 to 2. (Hydrogen and one isotope of helium are

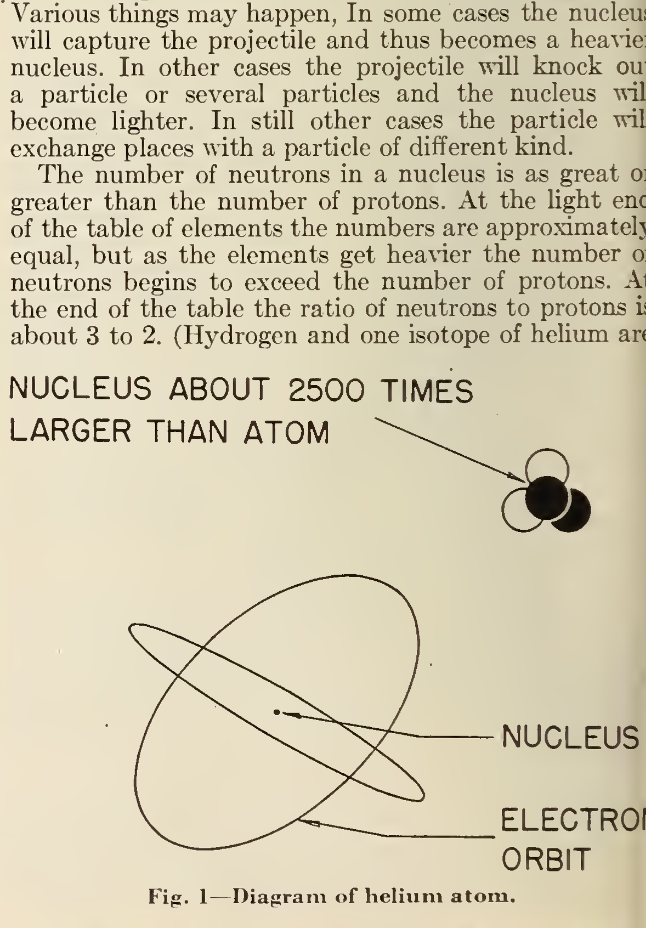

Fig. 1—Diagram of helium atom.

①Atomic Power, B. W. Sargent, *The Engineering Journal*, December, 1945.
②Atomic Energy for Military Purposes, H. D. Smyth, Princeton University Press.

exceptions to the rule.) Table I gives an example of the neutron content of the nucleus for elements near the ends, middle and quarter points of the natural series.

Table I

Neutron Content of Certain Nuclei

Element	*Mass No.*	*Atomic No.*	*Number of Neutrons*	Ratio: $\frac{Neutrons}{Protons}$
Helium	4	2	2	1.00
Manganese	55	25	30	1.20
Silver	107	47	60	1.28
Thulium	169	69	100	1.45
Uranium	238	92	146	1.59

Radiation

An excited nucleus may radiate gamma rays. These are like X-rays, travelling at the velocity of light, and lie toward the high frequency end of the spectrum from X-rays. The emission of gamma rays accompanies a great many other nuclear processes.

Showers or streams of particles are also called radiation. High speed detached electrons are called beta particles or beta rays. They are able to penetrate small thicknesses of matter. Many unstable nuclei have the ability of emitting a beta particle, in which case one of the neutrons becomes a proton, and the atom increases its atomic number to the next higher value without changing its mass number.

An aggregation of two protons and two neutrons is known as an alpha particle. Some heavy radioactive elements emit alpha particles. Because of their size these have little penetrating power and are easily stopped by a little solid matter. Alpha particles are the nuclei of helium atoms.

Shielding

Radiation is destructive to living organisms. The human body can be subjected with safety to only certain limited amounts. Consequently, all devices generating radiation must be shielded so that personnel can work in safety nearby. Gamma radiation is stopped best by heavy substances, and the material widely used for this purpose is lead. Where bulk is not a factor, less costly materials, such as iron or concrete, are also used.

Neutron radiation is very difficult to stop. Because of their absence of electric charge, neutrons can pass undeflected in close proximity to atomic nuclei. The neutron is so small with respect to inter-atomic spaces that it readily passes through large numbers of atoms without colliding with anything. A high speed neutron can be expected to travel in a straight line through several inches of almost any substance. Neutrons are slowed down in a way which is described later. Slow neutrons are stopped effectively by certain particular elements, two of these being cadmium and boron. It is generally advisable to arrange neutron shielding in the following steps. A material containing large numbers of light nuclei, usually hydrogen in the form of water or paraffin wax, is first interposed so that most of the neutrons emerging do so with low velocity. The next material will be chosen for its ability to stop slow neutrons and may well be cadmium. The final part of the shielding will in reality be shielding against the gamma radiation created by the neutron capture. An effective neutron shield could consist therefore of a water jacket, a cadmium plate and a lead plate each of appropriate thickness.

Radioactivity

The nuclei of some natural isotopes, and of many which can now be created by man, are unstable or radioactive. The degree of instability or activity is denoted by a period of time known as the "half life". The half life is defined as the length of time required for half of any given large number of atoms of one kind to disintegrate. At the end of this time the remaining half are still unchanged. It is impossible to predict when any particular atom will disintegrate, but it has a certain probability of doing so in each unit of time.

There is a fairly close analogy between the decay of a radioactive material and death in a human population. It is not possible to predict when any particular person will die, but there is a very definite probability that he will do so in a unit of time. This probability is so definite that life insurance companies can count on it and so do a flourishing business. Whereas the probability of a person dying increases with his age, the probability of an unstable atom disintegrating remains constant.

A long half life denotes relatively great stability. A short half life indicates an intensely radioactive isotope. The measured half lives of isotopes vary over an almost incomprehensively wide span of time, from 10^{-7} seconds to 10^{10} years.

Radioactivity is called alpha or beta activity according to the kind of particle emitted. Gamma radiation frequently accompanies the alpha or beta emission. Radioactive isotopes must be carefully handled, so people will not be injured by their radiation. It is most important not to permit certain isotopes to enter the human body through inhalation or ingestion because of selective deposition, usually in the bone. Once deposited the damaging radiation continues at the closest possible range.

Fission and the Chain Reaction

Some isotopes undergo a particular kind of disintegration known as fission. Although fission may occasionally occur spontaneously, it can be caused by bombarding the fissile nucleus with a neutron of appropriate velocity. The only readily available fissile isotope in nature is uranium of mass number 235. This nucleus contains 92 protons and 143 neutrons. When struck by a slow neutron it splits into two nuclei of smaller and generally unequal size. There are more than enough neutrons to satisfy the requirements of the two new nuclei and there will be, on the average, one to three set free.

A large amount of energy is released at fission. It is distributed in these forms: 1—As gamma radiation (intense). 2—As kinetic energy possessed by the two new nuclei which have high velocities. (This energy is imparted to and distributed amongst the neighbouring atoms by collision. The net effect is an increase in temperature, i.e., heat is released.) and 3,—As kinetic energy in the neutrons released.

It is possible to arrange pieces of uranium with respect to one another and to other materials so that one or more of the neutrons released at fission will be slowed down to an appropriate velocity and will then strike another U235 atom causing a second fission. The continuation of this process is known as a chain reaction. The system which will produce it is called a 'pile', a 'chain reaction pile', an 'atomic pile' or a 'reactor'. Since it has already come into wide usage, the word 'pile' is used here.

The Elements of a Pile

A pile, to use natural uranium, can consist in its simplest form of; (a), Fissile Material (the uranium), or (b), A moderator or neutron slowing-down material. Because there are 140 atoms of U238, which is not fissile by slow neutrons, present with each atom of U235, it

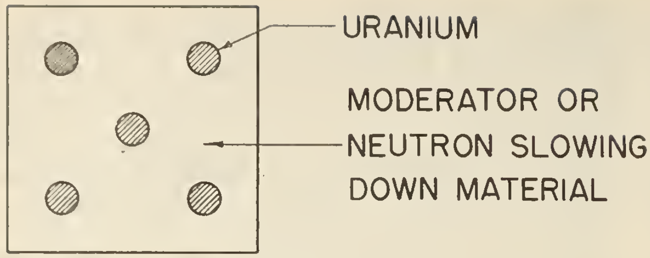

Fig. 2—Elementary pile.

is obvious that there will be collisions between neutrons and U238 nuclei. Some of these collisions will result in capture, which as we shall see later is the reaction ending with the creation of plutonium. Any neutron so captured is no longer available to sustain the chain reaction.

The probability of fission in U235 depends on the velocity of the striking neutron, and is greatest when the neutron has been slowed down to a negligible fraction of its original velocity. It is necessary, therefore, in some manner to slow down the neutrons resulting from fission before they are permitted to reach more uranium atoms. A material introduced only for the purpose of slowing down neutrons is called a moderator.

It is interesting to make here a simple analogy. A neutron migrating amongst atoms can be compared with a billiard ball moving on the surface of a billiard table. The neutron striking a heavy nucleus is similar to the billiard ball striking the cushion, it rebounds with almost undiminished velocity. If, on the other hand, it strikes a light nucleus, it imparts a substantial velocity to its target and suffers a large reduction in its own velocity. This is the condition which exists when a billiard ball strikes another billiard ball.

The requirements for a moderator are that it shall have nuclei of small mass, and that neutrons striking these nuclei shall not be captured. From the standpoint of small mass, the hydrogen nucleus is ideal, since it has the least massive nucleus, consisting of one proton. Unfortunately, the hydrogen nucleus does have a tendency to capture slow neutrons, and it cannot be used in a pile of natural uranium. The next lightest nucleus, consisting of one proton and one neutron, is that of heavy hydrogen which is also called deuterium. It makes a good moderator and is used in chemical combination with oxygen as heavy water. Approximately one in each 5,000 atoms in natural hydrogen is a deuterium atom, so that deuterium is not particularly scarce. It is, however, a very difficult and expensive operation to separate deuterium from ordinary hydrogen.

An alternative moderator material is carbon, which when pure has only a small tendency to capture slow neutrons. It has not as light a nucleus as deuterium. Carbon is used in the form of graphite, which can be quite highly purified. Another possible moderator is beryllium.

The elementary pile described above and illustrated in Fig. 2 is too simple to be used. If it would react at all, it would likely run away, as no means of control has been provided. In order to control it, one needs some way of curbing its runaway tendencies. These are caused by the fact that for each fission, more than one neutron is available to cause a new fission. The method of stopping this tendency is to introduce some material which will capture these surplus neutrons. A powerful neutron absorber is needed. The neutron capturing properties of cadmium and boron have already been referred to. If then, pieces of cadmium or boron can be inserted into the pile, these will serve as control devices. At a particular position setting the pile will run steadily. If the pieces are withdrawn then the rate of reaction increases. If they are inserted, the rate will decrease.

This elementary pile needs some further refinement. It is uneconomical in neutrons because these can escape freely at its boundaries. To decrease this loss the pile must be lagged just as one would lag a steam pipe to prevent unnecessary loss of heat. The pile lagging system is called a reflector. It is made of a material having a minimum tendency to capture neutrons. In such a medium, a portion of the neutrons outward bound and which would otherwise escape, are re-directed, after a series of collisions, back into the pile. A pile with a reflector may be a smaller physical size than one without. Fig. 3 depicts the pile with control devices and reflector added.

The next modification which must be made to this simple pile before it is very useful, is some provision for cooling it. If it is to operate in a steady state, with its temperature neither increasing nor decreasing, exactly as much heat must be removed as is generated in each unit of time. If operation at a few watts is sufficient, cooling can be provided by convection currents of the air in the room. If, on the other hand, it is desired to operate at many kilowatts, provision must be made to take away these large quantities of heat.

If cooling is accomplished by running some fluid, such as air or water, through the pile, then it is necessary to take account of the capture of neutrons in the coolant and in the materials used as pipes or ducts carrying it. Another modification, before this simple pile can be used, is the provision of shielding, so that people can safely come near it. This might take the form of a thickness of concrete wall.

There are not yet enough components to make the pile really workable. It will require some instrumentation, otherwise the operators will be unable to dedetermine the operating condition and the amount of response to the controls. So it must include some ionization instruments which will respond to neutron radiation, and which will transmit their measurement to external indicators. Fig. 4 illustrates a pile with these further additions.

Concept of Cross Section

The relative dimensions of an atom and its nucleus have already been mentioned. It should be emphasized that an atom consists almost entirely of vacant space. Imagine an atom magnified until its diameter appears

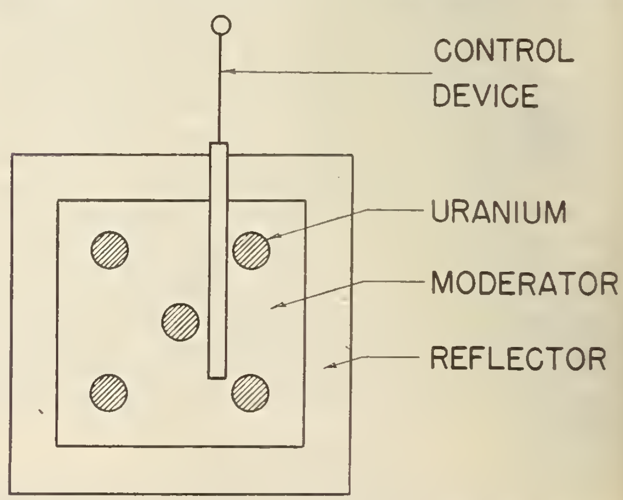

Fig. 3—Elementary pile with reflector and control device.

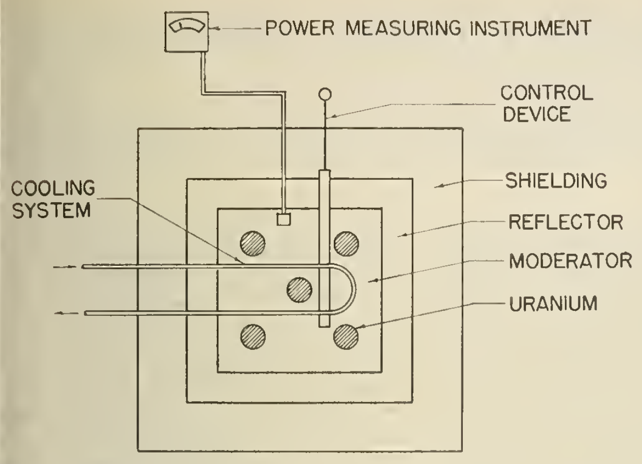

Fig. 4— Elementary pile with all essential components.

to be two feet. The nucleus will have been brought just into the range of human vision and will appear as a particle as big as a short cylinder cut from a human hair with height equal to diameter! On a volume basis the atom is about 10^{12} times the volume of its nucleus.

Reference has been made to the fact that materials differ from one another in their ability to capture neutrons. One wishes to be able to deal with neutron capturing and other properties on a quantitative basis. This is done by assuming that the different materials present different target areas to the bombarding particles, which are assumed to have zero size. If one knows the flux density of the particles, then the probability that a collision will occur can be computed directly from this area, which is called the cross section. In dealing with such minute areas as are presented by nuclei, the physicists have chosen a convenient unit called the "barn", which is 10^{-24}cm^2.

The term "cross section" is used to express the probability of a certain event occurring. "Capture cross section" denotes the probability of capture, and "fission cross section" denotes the probability of fission, and similarly with other events.

Cross section is an attribute not only of the kind of target nucleus but also of the kind of bombarding particle and its velocity. With ordinary uranium piles, the fission occurs with slow③ neutrons hitting U235 nuclei and most of the interest lies in cross section for slow neutrons. Good moderator materials have very small capture cross section; fractions of a barn. Materials used for control and shut-off devices such as cadmium and boron have very large capture cross section; hundreds of barns.

The Plutonium Reaction

When an atom of U238 captures a neutron it becomes U239, which is unstable, decaying by beta emission with a half life of 23 minutes to a new element not found in nature called Neptunium, which has an atomic number of 93. Neptunium 239 is also unstable and decays again by beta emission and with a half life of 2.3 days to another new element called Plutonium, atomic number 94. Plutonium 239 is weakly radioactive and decays by alpha emission to U235. Pu239 is fissile and is a most important nuclear fuel. Because it is a different element it can be separated by chemical means from the uranium in which it was born. It can be obtained as a pure fissile substance and hence is of military importance. The creation of plutonium 239 in uranium tends to overcome the impoverishment in U235 resulting from pile operation, since the plutonium formed will also serve to support the chain reaction.

Fission Products

The two new atoms formed by the fission of an uranium atom are in general highly radioactive. They will have more neutrons with respect to the number of protons than the equilibrium ratio for their mass. Most of these radioactive isotopes transmute by beta emission to the element of next higher atomic number. A single such transmutation is seldon sufficient to achieve a stable nucleus, and fission products go through a series of such decays finally to become stable atoms, though not always of an isotope known to nature.

The beta emissions are accompanied by gamma radiation, so that fission products are radioactive and dangerous. Since they are distributed throughout the whole of any uranium which has been reacting in a pile, the uranium is difficult to handle on removal, and it must be concealed behind heavy shielding. Fission products have another effect on pile operation. Some of the elements produced have neutron capturing properties, and they effect the reactivity of the pile. This effect is called poisoning.

Production of Radio-Isotopes

A wide variety of radioactive isotopes can be produced with a pile. These are created by subjecting inert materials to neutron bombardment. In many cases the element produced is a radioactive isotope of the element bombarded. An example of this kind is radio cobalt. The active material is diluted or mixed with the large amount of the original inert isotope. The specific activity in this case will not be high and will be limited by the neutron flux available for bombardment.

In other cases the element produced is different from that bombarded. An example is radio carbon which is produced by bombarding nitrogen. The active material in this case is diluted with a different element, so that it is possible by chemical separation to obtain a pure radio isotope. Intense specific activities are possible in this way.

Fission products are an enormous source of radio isotopes, since for each pound of uranium "burned" in a pile, a pound of fission products result. It is possible by chemical processes to separate the fission products from the uranium and from one another.

Isotope Separation

It should be pointed out that it is possible, using processes that are costly and technically difficult, to separate U235 from U238 so that a pure fissile material, or uranium enriched in U235, can be obtained. A pile using natural uranium ceases to react when the U235 content of its fuel is materially reduced. This makes the utilization of the remaining U235 a problem. In order to utilize all of the world's supplies of U235, it may be necessary to employ isotope separation processes.

Atomic Fuels

There are two elements which are currently regarded as being atomic fuels—uranium and thorium. Unfortunately, neither of these can be regarded as plentiful.

Uranium occurs as a constituent in the earth's crust to the extent of about 1 part in 250,000. It is a mixture of three isotopes which occur in the following amounts:

(Continued on page 267)

③A slow neutron (or thermal neutron) has a velocity in equilibrium with the temperature of the material in which it moves. In some of its collisions it will lose velocity and in others it will gain velocity. Its actual velocity is of the order of 7,000 ft. per second.

THE CHALK RIVER ATOMIC ENERGY PROJECT

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A paper presented at the Sixty-first Annual General and Professional Meeting of The Engineering Institute of Canada, at Toronto, Ont., May 8th, 1947.

The author traces the history of the project and tells how the site was selected. The administration and operating areas are described in detail. Though details of the "pile" itself cannot be disclosed, the general requirements and limitations affecting its design are discussed. The elaborate precautions taken for safeguarding personnel are outlined, as well as the many control devices and how they function. Descriptions are also given of the chemical area, power plant, water treatment plant, and village. Expenditures to date on the project are given, and savings effected by the use of surplus materials and equipment are enumerated.

In the September 1945 number of *The Engineering Journal,* issued soon after the world learned that two atomic bombs had been used to hasten the end of the war in the Pacific, there appeared an article entitled "The Atomic Bomb and Canada's Contribution to It." In that article was a brief description of some of the engineering features of the chain reacting pile at the Petawawa Plant, now better known as the Chalk River Laboratories of the National Research Council. It is the purpose of this paper to describe in more detail some of the general features of the project, including the village housing the operating and research personnel. No restrictions remain on the disclosure of facts regarding the village, though security regulations still forbid disclosure of many of the more interesting details of the pile and of the chemical processes for separation of the final products.

History

While nuclear physical research and development of fundamental design data had been in progress in the Laboratories of the National Research Council since 1942, it was not until well into 1944 that it was decided to proceed with construction in Canada of a pilot plant for the production of plutonium. At this stage it had been settled that the Canadian pile would be of the type using heavy water as a moderator, and shortly after the middle of the year the principal basic dimensions of the pile were fixed and a starting point for the design of the plant was therefore available.

Until this time all basic design work in connection with the pile had been done by the National Research Council. Design of a complete plant and village was, however, beyond the scope of that organization, and Defence Industries Limited, who had designed and supervised the construction of a number of large government-owned munitions plants during the previous five years, were requested to, and agreed to undertake the work.

Selection of Site

As the design of the pile was getting under way the search for a suitable plant site began. At the time, one of the principal requirements of the site was that it be remote from any large centre of population. It was known that cooling air would be required and that it would have to be discharged to the atmosphere in a radioactive condition. Just how serious this would be was not known, and it was the recommendation of scientists that the plant be kept well away from any large town.

Other site requirements were that an abundant supply of cold water be available, and that the location be reasonably accessible to scientists from the larger Canadian universities and preferably not too far from the Ottawa headquarters of the National Research Council. A site with a good general slope was desirable to facilitate gravity flow of water and chemicals. A suitable site for a housing development, not too close to the plant, had to be found, it being recognized that the isolation from large centres of population which was specified would preclude the availability of sufficient local labour to operate the plant. The scientific staff, which would come largely from the Montreal Laboratory, would also have to be provided with houses as it would have been too much to expect to find a sufficient number already available within a reasonable distance of any isolated plant site.

Railway siding facilities were not essential, the raw materials and final product being of small volume, coal being the only large bulk requirement. It is hoped that some day the use of coal at such a plant will become unnecessary.

Of a number of sites considered and inspected, that on the Ottawa River approximately five miles from the C.P.R. divisional point at Chalk River, fulfilled the requirements to the greatest degree. Its isolation is ample but it is not too remote, being not too far from Ottawa, Toronto and Montreal. The Ottawa river provides a large supply of cold water, the river here was deep, and quite cold at reasonably accessible depth. The site has an adequate slope and good foundation conditions, and an attractive site for a village, at a suitable distance from the plant site, was available. These plant and village sites were accordingly decided on, and an area of approximately 10,000 acres was expropriated, of which the village accounted for a little less than one square mile, the plant site for the other fifteen square miles. A quite small pro-

Fig. 1—Operating area (pile building).

Photographs illustrating this article supplied by the National Film Board.

portion of the plant site is actually occupied by the plant proper, the balance assures isolation from privately-owned property. The fact that the property adjoins one end of the large Petawawa Military Reserve reduced the amount of land which had to be expropriated, that end of the reserve being unoccupied.

Plant in Two Parts

The plant consists of some one hundred buildings and structures along with the outside steam, air, power, water and sewer lines serving them. A system of gravelled roads and paths connects all buildings. The plant area proper can be divided roughly into two parts, namely the administrative area and the operating area. The former contains the usual gatehouse, office building, cafeteria, shops, general stores and storage buildings, bus garage, fire hall and laundry, as well as the plant hospital and medical research centre, an instrument shop and an electronics laboratory. The operating area contains a number of laboratory buildings, the pile building and auxiliary buildings, the chemical extraction plant, a water filtration plant and a boiler plant, electrical sub-station and pump house.

Of most of the buildings it need only be said that they are of conventional types built for semi-permanence, all are on concrete foundations and most are of wood frame construction. There are, however, a number of structures which by their nature are of a permanent type. Into this category fall the power house, filtration plant and pile building, all of which are of concrete, steel and brick.

The Administration Area

In the administration area such buildings as the gatehouse, office, cafeteria and storage buildings have no especially noteworthy features and require no comment. Others are, however, unusual to some degree. The shops, though conventional, are, due to the relatively isolated nature of the site and to the need for building special experimental equipment on short notice, somewhat more extensive than would be warranted in a normal plant of similar size located close to a large city.

A portion of the medical centre is equipped for emergency treatment of plant accident cases, but the largest part is devoted to preventive health control and to medical research. As is now well known, exposure to large amounts of radioactivity can be

Fig. 2—Pile building.

Fig. 3—Chemical plant.

extremely dangerous. The nature of the Chalk River plant is such that large quantities of radioactive materials are present in certain parts of the plant, and precautions must be taken to make sure that personnel are not unduly exposed to them. The responsibility for checking to make sure that working conditions are safe from a radiation viewpoint rests with the health control section.

In this connection it might be noted that the permissible radiation exposure level chosen for operation of the plant is much below the tolerance level generally accepted as safe for this type of work. In other words the policy is to lean heavily towards the safe side in questions of health. A large part of the medical centre is given over to research connected with radioactivity, a number of laboratories being provided, as well as an animal house and a greenhouse, and a building having 2 million volt X-ray equipment for use in special biological radiation research.

The instrument shop is a necessity due to the large number of instruments of all types used in many parts of the plant. The shop is equipped to calibrate and repair this large variety of instruments, and to make up special ones normally available outside only with difficulty or not at all. The electronics laboratory is responsible for the development of special electronic equipment, prototype construction, calibration and repair. The importance of this department will be realized when it is considered that the detection and measurement of radioactivity deals largely with extremely small quantities of electricity.

As no plant personnel lives within walking distance and no previously established transportation systems were available, a substantial fleet of busses had to be acquired. A garage for housing and servicing the busses and other transportation equipment had therefore to be built.

The Operating Area

In the operating area are several research laboratory buildings of various sizes, the smallest having a floor area of about 5000 square feet and the largest an area of approximately 14,000 square feet. These laboratories are for research work in connection with nuclear physics, technical physics and chemistry. The materials handled in some of the laboratories can be highly radioactive, and special precautions have to be taken to protect personnel from exposure. Accordingly the laboratory floors and walls in some sections are of concrete to pre-

Fig. 4—Chemistry laboratory.

vent the escape of radiation to the outside or to adjacent rooms. Experiments are carried on by remote control and general ventilating air supply and fume hood exhausts had to be given special consideration. Fans are driven by steam turbines to ensure continuous adequate ventilation even during electric power failures. As highly radioactive materials are transported and handled behind the protection of several inches of lead, floors had to be designed for unusually heavy loads. Special clothing is worn and checked regularly for pick-up of radioactive contamination.

In laboratories used for inactive chemical research, however, these special precautions are not required. The laboratories themselves, therefore, have few especially noteworthy features. Similarly, the technical physics and nuclear physics laboratories have no unusual health exposures and are of conventional construction.

The Pile

The pile building is the central feature of the project, but it will be realized that the details of the pile are still of a secret nature and can not yet be disclosed. However, an outline of the general requirements and limitations of its design will at least give some idea of the difficulties which had to be overcome. In the first place the reacting part of the pile, contains the two components essential to the chain reaction, namely uranium and heavy water, but it also contains cooling water, air, and materials for confining the liquids.

The amounts of these materials and their disposition are fixed by nuclear physical considerations, and it accordingly was too much to expect that the general dimensions and proportions of the pile and the arrangement of the materials therein would be good from an engineering point of view. All materials absorb neutrons to some degree, and for the functioning of a uranium pile this absorption must be kept low. No known materials combine low absorption with high strength and satisfactory workability, and a compromise had to be made in the choice of a material for fabrication of the containing devices for the heavy water and for the cooling water.

In order to obtain high rates of heat transfer, and to minimize the absorption of neutrons in the cooling water in the system by reducing the amount of water present, the cooling water velocities had to be kept at a much higher value than would normally be favoured.

Elaborate Precautions Taken

But there were other difficulties to be overcome. The reacting part of the pile had to be surrounded by a reflector, which has the property of diverting back into the pile neutrons which would otherwise be lost. The whole had to be surrounded by a complicated system of shielding consisting of lead, steel, cast iron, water, many feet of concrete and other materials. Means had to be provided for introducing into the pile the uranium, heavy water and cooling water, and for removing them. No unshielded holes were permissible through which those materials could be handled, and it will be realized that the pile is a very complicated structure and that it presented design problems both novel and difficult.

Reference has been made to shielding. A word of explanation is in order. When the pile is in operation at normal power output, there is in the interior an intensely strong emission of very harmful radiation. The intensity of the harmful gamma radiation alone is equivalent to that which would be given off by a mass of radium many times larger than the entire world production to date. The precautions that are taken in shielding the few milligrams or grams of radium used by hospitals give some indication of what protection is needed for the pile. It is fortunate that most of the radiation can travel only in direct lines, hence pipes or other devices may be introduced in other than straight lines, always taking care that the total amount of protection in any direct line is not reduced below a set minimum.

The complications for which the radiation is responsible would not be nearly so serious if the radioactivity could be turned off at will, but there is no known way, or any likely future way, of accomplishing this. The pile can, of course, be shut down, that is, the self-sustaining chain reaction can be stopped. If the rate of operation has been high however, the interior of the pile will be highly radioactive and this radioactivity will decay at a fixed rate. It may still be too intense to permit access to the interior of the pile months after the chain reaction has been stopped.

The pile is expected to provide unusual opportunities for experimental work in nuclear physics. Many experiments will, in part, consist of exposure of different elements to radiation of various intensities. In

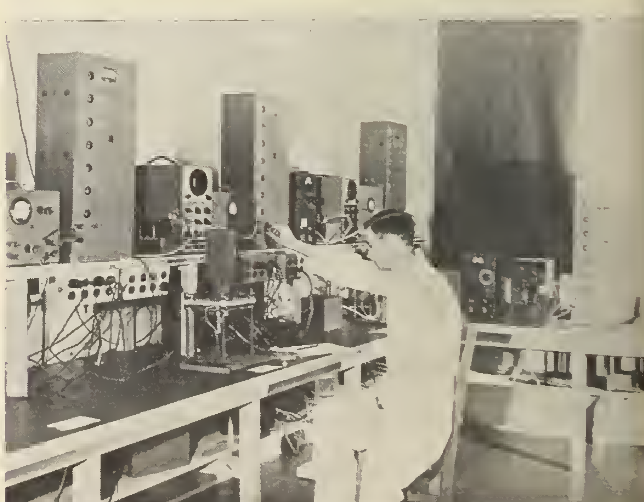

Fig. 5—Radioactivity counting room.

order, therefore, to make such exposure possible means must be provided for introducing samples of material into the interior of the pile. This is done by leaving holes of various sizes in the pile structure. To avoid leakage of dangerous radiation through these holes, plugs must be provided, and to stop radiation from shooting through the annuli between plugs and holes, both plugs and holes must be stopped. Samples to be exposed to radiation may be inserted in the plugs in various locations.

Many Unusual Problems Encountered

When the pile is in normal operation, a large amount of heat is generated within it. While this all stems from the fission of the uranium, a very substantial proportion is actually liberated outside of the uranium itself. This is because the energy originating in the uranium is in the form of particles travelling at extremely high speed, whose energy is given up when they are slowed down or stopped by collision with the materials in the system. Hence all materials in the interior of the pile tend to heat up to a greater or lesser degree, depending on the nature of the materials themselves and on the intensity of radiation to which they are exposed.

The thermal expansion of these materials had to be investigated very carefully to make sure that experimental plugs and other items inserted into the pile, either permanently or intermittently, will not foul any part of the structure under any of the temperatures expected to be encountered during the operation of the pile. As clearances around plugs and other similar items had to be kept small to minimize radiation leakage, it was not only necessary to make sure that expansion would not be more than calculated clearances. It was also essential that the whole massive structure be assembled to individual tolerances of a few thousandths of an inch. The remark was made while installation was proceeding that the erection was a watchmaker's job. Apart from the question of size, the remark was not too fanciful. The fact is that the construction of the pile presented a number of most unusual problems, and called for extreme care in setting the components, great accuracy on measurements, and meticulous care throughout. Great credit is due the construction staff of the general contractor, Fraser Brace Limited, for their successful performance of this work.

The key component of a chain reacting uranium pile is the uranium 235 which, however, is present in normal uranium to the extent of only about seven tenths of one percent. The U·235 is present in much too small a proportion of the total uranium to turn the pile into an efficient atomic bomb. However, the chain reaction, once started, must be controlled or the rate of heat production could increase, at a rapid rate, to the point where the uranium would melt or even cause an explosion, not of atomic violence, but still an explosion. Either of those occurrences would damage the pile irreparably, hence it becomes necessary to provide means for controlling the rate of reaction of the pile.

Many Control Devices Used

As mentioned earlier, all materials absorb neutrons to some degree and the structural materials inside the pile are chosen for low absorption in order for the pile to function at all. For control, it is necessary to introduce materials having high neutron-absorption characteristics. This is required in order to trap all neutrons in excess of those necessary to maintain the operation of the pile at any given level of power output. Two elements having very high absorption characteristics are boron and cadmium. These materials are accordingly used in the control devices.

Fig. 6—Nuclear physics research laboratory.

The number of devices initiating operation of the various controls is considerably greater than needed to ensure the safety of the operation. However as the whole installation is in the nature of a pilot plant, it was considered desirable to test the functioning of a large number of devices in order to prove which are the best and which ones are actually required. Tripping of any one of a good many hundred individual units will shut down the pile. It seems quite probable that a substantial number will be found unnecessary, and subsequent piles will benefit from this experience.

Ionization chambers are used in a large number of places for detection of radioactivity. A number are located in the operating areas of the pile building and in various other places in the plant to ensure that under no conditions will personnel be exposed to dangerous amounts of radiation. They are also used to measure the amount of radioactivity discharged to the river, and to ensure that the very large factor of safety set for such discharge is not lowered. Portable devices, containing their own ionization chambers, power supply and amplifiers are also employed for surveying all areas not covered by fixed devices, where radioactivity might be encountered.

As all material entering the pile becomes radioactive to some degree, it follows that the cooling water is also affected. Luckily the activity of water falls off at a rapid rate, though not so quickly as to permit the water to be discharged to the river directly after use. It is therefore held in baffled tanks long enough for the activity to die down to a very low intensity. All water and other effluent that may be radioactive is monitored before it enters the river, so that a complete record is kept of exactly how much radioactivity is discharged into the stream. The total is kept very low, so low in fact that from a radioactivity viewpoint the effluent would be quite safe for regular use as drinking water. Also, the activity dies away more and more as the water flows downstream.

Fig. 7—Shopping centre at Deep River Village.

The Chemical Area

During the stay of the uranium in the pile a percentage is converted into plutonium. This product must be recovered for use in further experimental developments. Its separation from the original materials becomes necessary. To effect this result the uranium-plutonium mixture must be removed from the pile and treated chemically. When it is removed from the pile, the mixture is intensely radioactive, and must be kept carefully shielded at all times while being transported to a chemical plant for the separation of the plutonium from the mixture.

All radioactive materials in process, except those of very mild intensity, must also be shielded. In the chemical plant this protection is provided by concrete walls of substantial thickness. Chemical solutions made up for use in extracting the desired products can be prepared and stored outside the shielded area in vessels accessible to operating personnel. The actual extraction operations however must be carried on behind the heavy concrete walls, all by remote control. Extensive control boards are therefore necessary.

The nature of the chemical process is such that a great deal of piping is necessary, hence numerous pipe lines must pass into the shielded area and between rooms of this area. None of these pipes can be permitted to pass through the thick concrete walls in continuous straight lines; they must follow curved paths or be diverted at an angle within the walls. This feature naturally added many difficulties to design and to construction. In addition, after the plant has been in operation the shielded spaces cannot be entered until all possible radioactive materials are removed, and until the activity of any quantities remaining is allowed to decay to a safe value. It has therefore been necessary to take precautions in design, construction and testing far beyond those which could be considered in a commercial plant, where leaks or other defects which might show up in the early stages of operation are accessible for repair.

The chemical plant operations are the final stages of the production processes at the plant. However, a short description of some of the other features may be of interest.

The Power House

The power house, located on the bank of the Ottawa River, contains a water pumping station, power distribution substation, air compressors and boilers. Both electric power and steam are used for driving the water pumps and air compressors, the steam drives being used to ensure continuity of supply in case of electric power failure. Power is taken from a substation on the property, the substation being at the end of a 110,000 volt transmission line erected primarily for the Chalk River plant, but soon to supply power as well for construction of the Ontario Hydro Electric Power Commission's new development at Des Joachims a few miles upstream. Emergency power for essential lighting and process loads is provided by two gasoline engine driven generator sets. The boiler installation supplies all the steam required for processes and for heating the plant buildings, the steam being distributed through an overhead piping system.

The Water Treatment Plant

A water treatment plant of substantial size has been built. Chemical treatment has been provided for, and filtering equipment of capacity sufficient to provide the needs of a small city has been installed. The filters are of the rapid sand type with the usual mixing chambers, sedimentation basins and clear wells. The pumps for pumping the water from the clear wells into the pressure mains are housed in the filtration plant building.

Both power plant and water treatment plant, while they presented some special problems due to site conditions, and the more than normal requirement of reliability of service, are largely conventional in design and detailed description is not necessary here.

The Village

Several possible village sites were investigated, and one on the Ottawa River, six to seven miles away from the plant building in a straight line, was chosen. Though this much separation of plant and village may have been unnecessarily large, the site chosen is actually considerably more attractive than those available nearer to the operating area.

The site was mostly wooded, though part was occupied by a small summer cottage and several log cabins housing Indian families. It has sandy soil and good general drainage, therefore excavation is easy and foundation conditions are good. The topsoil is, however, very sparse and light and a good deal of treatment and addition of topsoil was necessary to provide for lawns and to control erosion.

Living accommodation consists of about three hundred and sixty dwellings, a staff hotel housing approximately two hundred persons, and dormitories for about three hundred. The dormitories are actually eleven separate buildings, all arranged for two persons per room. About sixty percent of the dwellings are Wartime Houses, moved either in panels or in halves from Parry Sound, Nobel and Arvida. The balance are single family or two family houses or four family apartments, some moved in panels from Nobel, but mostly built new.

The village is self-contained, with its own water pump house and chlorinator, Imhoff tanks and chlorination chamber for sewage treatment, boiler plant, administration buildings, hospital, school, post office, bank, department store and groceteria, barber, tailor, and shoe repair shops, beauty parlor and community hall. The latter contains bowling alleys, meeting hall, library and an auditorium with projection booth, also a coffee shop where one can buy a snack outside of ɘgular meal hours. The above facilities were provided) meet the regular day-to-day needs of the villagers. embroke, nearly thirty miles away, is sufficiently ırge and close enough to supply most other requireıents.

A word about the choice of the name of the village ıight be of interest. The section of the Ottawa River ı the general vicinity of the plant and village is very eep, so much so that the adjoining land on the ntario side has been known locally as Deep River ɔr many years. In fact there is a record of a French xplorer who went up the Ottawa in the sixteen ighties and reported that the district was then known y the French equivalent of Deep River. As there 'as no other post office of the same name in Canada nd as the name, Deep River, was euphonious and ot easily misunderstood, it was decided to call it that.

Conclusion

Little more can be said about the village, the pile nd the plant itself within the limits set by time vailable and security regulations. It is felt however hat a few other facts should be known.

The Chalk River Project is comparable in cost to he largest chemicals and explosives plants built in ;anada during the war, the expenditures, including apital and operating costs, as reported in Hansard, aving been as follows:

For the fiscal year 1944-45..	$ 2,830,106.82
For the fiscal year 1945-46..	14,202,466.82
For the fiscal year 1946-47 (to February 28, 1947)..	6,504,828.26
making a total, to that date, of	$23,537,401.90

A point that should be of interest to taxpayers is that a substantial amount of government-owned assets from other plants was utilized. In addition to the Wartime Houses and other houses mentioned earlier, items moved from elsewhere included construction camps, mess halls, cafeterias, emergency generator sets, boilers for plant and village, shop equipment and a large number of other items, many small, some large. In all, assets costing originally in the order of $2,000,000 were dismantled and moved to Chalk River.

Last, but by no means least is this. The Chalk River pile is an original design. While certain basic nuclear physical data was pooled by Canada, Great Britain and the United States, only a very limited amount of data on a different type of pile from that at Chalk River was available to Canada. To all intents and purposes the complete design of the Chalk River plant, except for the basic nuclear physical data, was originated and developed and the plant was brought into being by the efforts of Canadian and British engineers.

ENGINEERING NUCLEONICS

(*Continued from page 261*)

U238—99.28 per cent—half life 4.51 x 10^9 years.
U235— 0.71 per cent—half life 7.07 x 10^8 years.
U234— .006 per cent—half life 2.69 x 10^5 years.

Uranium is a heavy metal, sp. gr. 19, with a melting point about 1100 deg. C. It corrodes in both air and water rather more vigorously than iron.

Thorium occurs more extensively, being about three times as plentiful as uranium. Only one isotope Th232 is found in nature. It is also a metal, sp. gr. 11.5, and melting point about 1840 deg. C. Its oxidation properties are very similar to those of uranium. The half-life of Th232 is 1.39 x 10^{10} years.

Although the energy equivalent of mass is obtained by multiplying by a factor equal to the square of the velocity of light, we have no method as yet of converting very much matter into energy. In the fission of U235 the mass of the fission products accounts for almost all of the original mass, only about 1/10th of 1 per cent being converted into heat energy. One pound of U235 will yield about 10^7 kilowatt hours of energy.

POWER PRODUCTION FROM NUCLEAR REACTORS

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A paper presented at the Sixty-first Annual General and Professional Meeting of The Engineering Institute of Canada at Toronto on May 8th, 1947.

Starting with the recovery of energy from primary piles, Dr. Wiggins describes within the limits imposed by security regulations, the materials, devices and methods used in the production of power, as well as those used in producing energy from secondary piles. A diagrammatic illustration is given in the latter case of a hypothetical power plant. The most promising immediate applications of nuclear energy are discussed, as well as the possible applications of radiation in medicine, chemistry and industry. The effects of radiation on structural materials and on personnel are listed. Reasons are given as to why nuclear energy must remain a public utility.

The purpose of this paper is to attempt to answer that often-asked question: "When will we have atomic power?". To this there is no positive answer, since the time required will depend entirely on the effort put into the development. However, some idea may be given as to what can and cannot be done with nuclear energy, and how much development lies ahead before commercial nuclear power is a reality. The picture presented will not be as specific nor as complete as a gathering of engineers deserves. The shortcomings are largely a result of the heavy security restrictions on the technology of power reactors, which have made it necessary to omit most of the interesting details such as actual arrangements, dimensions, and so forth.

It should be mentioned that there is always the possibility that further research in nuclear physics will change the entire picture before some of the steps described are actually taken. However, we have no definite reason to expect this occurrence within the next decade or so. It is felt that immediate progress will be in the direction of higher efficiencies, rather than of radical changes. As will be seen, much can be done on the basis of present knowledge alone.

The first paper of the series, presented by Mr. Tupper, outlined the fundamental principles of nuclear science, and described a simple nuclear chain reacting system. It is proposed to start at this point and show the ways in which useful power and other by-products may be obtained from nuclear reactors. A few topics of particular importance in nuclear engineering design will be discussed separately in view of their greater interest to engineers. Finally, an attempt will be made to review the whole picture of nuclear power production as it appears today.

Energy Production from Nuclear Fission

As mentioned in the first paper of this series, a quantity of energy is released each time a U235 atom undergoes fission. The source of this energy is the annihilation of a small part of the mass of the nucleus during fission. We know that the fission of a nucleus will yield two large fragments of comparable size, plus several neutrons. In the case of U235, the total mass of these fission fragments and neutrons is found to be approximately 1/10 per cent less than the original mass of the nucleus. This 1/10 per cent of mass reappears as energy according to the relation $E=MC^2$, where E is the energy release in foot-poundals, M is the loss of mass in pounds, and C is the velocity of light in feet per second. Thus, we find that the quantity of energy released by the fission of one pound of U235 is approximately 12,000,000 kwh.

Energy released in form of heat

At the present time it does not appear possible to release this energy in any form other than heat. The bulk of the energy of fission appears in the two large fission fragments, which move away from each other at enormous velocities. A portion of the energy is imparted to the neutrons, while the remainder is carried by the gamma radiation emitted at fission. The fission fragments are soon slowed down by collision with the other uranium atoms, and in so doing liberate their kinetic energy in the form of heat. The neutrons, the gamma radiation from fission, and the radiations from the fission fragments are absorbed in the uranium or surrounding materials, yielding smaller quantities of heat.

Thus, the immediate result of a fission reaction in uranium is an increase in the temperature of the uranium itself. This heat may be removed by passing some suitable working fluid over the uranium. The thermal energy of the working fluid may then be converted to mechanical or electrical energy by conventional means, as for example by a steam boiler and turbine. There is a remote possibility that it may eventually be possible to recover nuclear energy by more direct routes, but this is still well in the future.

Fission chain reactions

The first paper also discussed the way in which a large number of U235 atoms could be made to undergo fission, i.e. the use of a neutron-induced chain reaction. A chain reaction may be maintained in natural uranium by the artifice of slowing down the fission neutrons in a moderator before allowing them to encounter other uranium atoms. In this way, capture of neutrons by the predominant isotope U238 is avoided sufficiently to allow the continuance of the chain reaction in the U235 isotope. Those neutrons which are captured by U238 produce the new fissile element plutonium.

The fission chain reaction in natural uranium has been carried out on a large scale in the United States for the production of plutonium. The reaction takes place in an assembly of uranium metal and graphite moderator commonly known as a "pile". The quantity of heat released in the pile is very large if an appreciable amount of plutonium is produced. We are told in the Smyth report that the production of one pound of plutonium per day involves the liberation of heat at the rate of 250,000 to 750,000 kilowatts.

OOLING WATER NOT A SOURCE OF USEFUL POWER

However, in the piles constructed during the war iis heat is removed by cooling water at too low a emperature to be available as useful power. Since ie objective is the production of plutonium at the ighest possible rate, the cooling systems are designed o remove the largest amount of heat per unit weight f uranium. This requires that the exit cooling water emperature be so low that the availability of the eat is little better than that in the condenser cooling rater from a steam power station.

It is true that uses might be devised for this low rade heat under favorable circumstances, as for instance in heating systems with the aid of a "heat ump". However, since safety considerations will robably make it undesirable to locate plutonium roduction piles in urban areas, such circumstances vill be rare. It is clearly necessary to raise the temerature of the coolant, leaving the reactor if reason.ble thermodynamic efficiency is to be obtained. The nethods by which this may be accomplished for the ecovery of useful power from nuclear fission will iow be discussed.

Power Production From Primary Piles

The operation of a natural uranium pile, often ermed a "primary pile", is a necessary first step in he utilization of nuclear energy. Such piles have so ar been designed to yield plutonium as the only useul product. If power is the principal interest, the lutonium need not be separated, but may remain n the pile to contribute to the total energy release. Some combination of the two objectives may be desired in a particular instance.

In a natural uranium pile, nuclear physical considerations necessitate the use of a so-called heterogeneous system, in which the uranium is in relatively large pieces, separated by layers of moderator. We are told in the Smyth report that the uranium used in the piles constructed in the United States during the war was in the form of short cylinders individually sealed in aluminum cans. These cylinders were arranged in strings, in channels running through the graphite structure which served as the moderator. The cylinders were cooled by water conveyed through aluminum tubes surrounding the cylinders. The aluminum cans thus served the dual purpose of preventing corrosion of the uranium, and of preventing fission products from escaping into the cooling water.

LOW TEMPERATURES OF EXIT COOLING WATER

The use of aluminum and water in a pile immediately imposes temperature limitations. The neutron capture cross-section of water is sufficiently high that thin layers of correspondingly high velocity must be used in the cooling system. Due to the peculiar distribution of heat production in a pile and the steep temperature gradients involved, the bulk exit temperature must be well below the maximum surface temperature. The maximum surface temperature is set by the risk of aluminum corrosion and surface boiling. The net result is that a temperature well below the boiling point is the highest likely to be attained in the exit cooling water with an aluminum system.

Let us see how the primary pile might be redesigned to allow recovery of thermal energy at a higher temperature. Since the cooling fluid and the materials of the cooling system impose the principal temperature limitation, we should consider the use of combinations other than that of aluminum and water.

NO PRESENT ALTERNATIVE FOR ALUMINUM

In a natural uranium system the proportion of spare neutrons is quite small, and thus the additional materials introduced for the cooling system must have small neutron capture cross-sections, and be used in minimum quantities. In practice, aluminum and beryllium are the only materials which have sufficiently low capture cross sections and acceptable mechanical properties. Pure beryllium is difficult to produce, and its capability of fabrication into the forms required in a pile is still uncertain. Thus we are reduced to aluminum as the only choice for the present.

Somewhat greater freedom is possible in the case of the cooling fluid, although here again only substances of low neutron capture can be used. In addition, the coolant must be chemically stable and be one which does not undergo nuclear reactions leading to the formation of long-lived radioactive products with an embarrassing disposal problem.

WATER THE BEST COOLANT

Considering liquids first, the obvious choice of ordinary water turns out to be one of the best possible choice of materials. Pure water forms radioactive products, which decay sufficiently rapidly that no serious disposal problems result. However, its neutron capture cross section, due to its hydrogen content, is sufficiently high that care has to be taken to use the thinnest practicable layers. Heavy water has a much smaller neutron capture cross section, and might conceivably be used by circulating through the pile and a heat exchanger cooled by ordinary water. While this would allow greater freedom of design of the pile cooling system, the net availability of heat would be no greater and the added complexity of the circulating system would outweigh any advantages.

SOME GASES ARE POSSIBLE ALTERNATIVES

At the present time no other liquids appear to be available with sufficiently low capture cross sections and chemical stability under irradiation. A rather more hopeful picture is presented by the possibility of gas cooling. The most promising gases from the point of view of low capture cross section and chemical inertness are helium and carbon dioxide; hydrogen, air and nitrogen are less desirable by virtue of their higher capture cross sections, oxygen by the danger of oxidation of the graphite or aluminum surfaces in the pile.

The use of gas cooling introduces several advantages over liquid cooling. Wider cooling passages may be used and the total size of the pile may be reduced as a result of their much smaller neutron capture cross sections. Corrosion and film formation on the cooling surfaces are almost completely eliminated, allowing the use of much higher surface temperatures. The use of gas cooling in fact considerably increases the number of possible sites for primary piles, by eliminating the requirement for large quantities of pure cooling water.

DISADVANTAGES OF USING GASES

As usual, there are drawbacks as well as advantages. Unless very high gas velocities and pressures or elaborately extended cooling surfaces are used, the amount of heat removable per unit weight of uranium will be smaller than with a liquid cooled pile. The use of high gas pressures introduces a serious hazard from leakage of radioactive gas, and involves mechanical complications in charging and discharging uranium while the pile is operating. A circulating coolant system with a heat exchanger would have to be used, since the cost of the coolant is far too great to permit single-pass cooling. Recirculation involves the danger of contaminating the entire cooling system in the event of leakage of fission products from the uranium, while in a straight-through water cooling system only the outlet can become so contaminated. Standby blowers and power systems would be required to maintain gas cooling in the event of failure of the normal supplies, since the simple expedient of a reserve gravity tank cannot be adopted as with water. It is nevertheless true that most of these difficulties can be overcome, since they are design problems rather than fundamental obstacles.

ENERGY RECOVERY FROM GAS COOLED PILES

So far we have said nothing specific about the possible energy recovery from a gas cooled pile. This is largely due to our present lack of knowledge of permissible operating temperatures in the pile, due in turn to the uncertainty of the combined effects of temperature and radiation on the mechanical properties of the aluminum. Even in the absence of radiation, a definite upper temperature limit is set by the rapid fall off in strength of pure aluminum. Some improvement may conceivably be obtained by the use of high-strength alloys in thinner sections to compensate for their greater neutron capture, although this is still a matter of doubt. However, most authorities agree that there is a good chance of recovering more than enough power to operate the pile itself and the associated equipment. Combining this consideration with the greater freedom in the choice of site, it is likely that future primary piles will tend more and more toward gas cooling.

In summary, we see that it should be possible to design future primary piles, so that useful power is a product in addition to or in place of plutonium. However, as with all natural uranium piles, the units will be physically large and not well adapted for use by individual industrial or municipal power consumers. The next section will deal with reactors which can be constructed in sufficiently compact form for general use.

Power Production from Secondary Piles

A chain reacting system using uranium which contains more than the normal 0.7 per cent of fissionable material offers many advantages. Since the ratio of U238 to fissionable material is lower, the relative loss of neutrons by capture in U238 is also smaller. More neutrons can therefore be lost by other processes without stopping the chain reaction.

The latter consideration permits much greater freedom in the design and operation of the nuclear reactor. Constructional materials suitable for high temperatures may be used in spite of their greater neutron capture. A larger fraction of the volume of the reacting system may be devoted to cooling passages and other equipment. Finally, the complete unit may be greatly reduced in size, since greater losses of neutrons from the surface of the system can be tolerated. The foregoing remarks should not be interpreted as meaning that one can be too prodigal in consumption of neutrons. While a chain reaction can be maintained with a large wastage of neutrons, it will do so only at the expense of a large consumption of fissile material. Thus, economy of nuclear fuel dictates the use of the minimum quantity of neutron absorbing material which will achieve the desired performance characteristics.

METHODS OF PRODUCING ENRICHED URANIUM

Reactors operating on uranium which contains more than the normal proportion of fissionable material are frequently termed "secondary piles", since preliminary operations are required to produce the enriched uranium. Two general methods are available for this purpose. The first involves the removal of a portion of the U238 isotope from natural uranium, leaving the remainder with a higher ratio of U235 to U238. This separation was carried out on a large scale in the United States during the war for the production of U235. The processes employed were the diffusion of gaseous uranium compounds through porous barriers and the electromagnetic separation of uranium ions. While apparently a simple and direct method, isotope separation actually involves the construction of very large and expensive equipment. The total expenditure on isotope separation plants in the United States was of the order of a billion dollars. The plants could undoubtedly be much smaller where only partial separation of U238 from U235 were required, but would still represent a major industrial effort.

The second method for production of enriched uranium involves the addition of plutonium in place of U235. The plutonium is produced from natural uranium in a primary pile as described in the preceding section. The primary piles themselves are large and expensive units, requiring associated plants for the chemical separation of plutonium from uranium. However, they have the pronounced advantage of being capable of producing useful power, while isotope separation plants are necessarily large consumers of power.

LIMIT TO SIZE OF UNITS

As already mentioned, greater freedom of design is possible with secondary piles than with primary piles. This freedom may be used to advantage by raising the working temperature to permit efficient recovery of power, and by reducing the overall size of the unit. Needless to say, the reduction in size is eventually limited by the difficulties of removing energy at a high rate from a small volume, so that power producing units will have an optimum size for any particular service. Yet the size can certainly be reduced to the point where secondary piles may be used to replace coal-fired boilers in the larger steam power stations, and even to much smaller proportions in special cases.

The secondary pile will normally be designed to operate at the highest temperature consistent with long life and reasonably small neutron losses, though other considerations such as low construction costs or ruggedness may be involved at times. Unfortunately, we cannot discuss the actual arrangements likely to be used, due to the present security restrictions. We can, however, point out the principal ways in which power-producing secondary piles will differ from low-temperature primary piles.

CHOICE OF COOLANTS

The coolant can be water, helium or carbon dioxide as with primary piles, or it can be a molten metal of reasonably low capture cross section, such as bismuth or lead. The common high-temperature organic coolants such as Dowtherm or tetra cresyl silicate are not likely to be sufficiently stable under irradiation for the purpose. Any of the coolants mentioned could theoretically be used at temperatures limited only by the other materials of construction. The use of water (as steam), helium or carbon dioxide would require high flow rates and pressures for efficient heat transfer. This would be partially offset by the possibility of using the hot gas directly in a gas turbine without an intermediate boiler. However, since the coolant will become radioactive in circulating through the pile, the gas turbine would require shielding and elaborate precautions to prevent leakage.

The molten metals offer attractive possibilities for high-temperature piles, in spite of their somewhat greater neutron capture. Large amounts of heat can be removed at relatively low pressures and flow rates, and can then be efficiently transferred to a second working fluid in a conventional heat exchanger. The second working fluid would probably be steam to enable the use of existing types of auxiliary equipment and prime movers. The insertion of the heat exchanger would effectively isolate the two fluid circuits, and prevent contamination of the mechanical equipment by radioactive products.

CHOICE OF MATERIALS

The materials used to enclose the coolant in a high temperature pile must be selected on the basis of reasonably low neutron capture, high melting point and resistance to attack by the cooling fluid. Aluminum and its alloys have serious temperature limitations, as discussed earlier. Stainless steels offer much better possibilities due to their excellent temperature and corrosion resistance. The neutron capture of a typical stainless steel is unfortunately rather high, although this is offset by the strength and fabricating properties which enable the use of thin sections. The possibility also exists that refractory materials may be developed in the future which are stable under irradiation, impervious, and at the same time reasonably good heat conductors.

CHOICE OF A MODERATOR

The choice of the moderator for use in a high temperature pile involves the normal considerations of low atomic weight and low neutron capture in addition to temperature stability. The material most frequently used in primary piles, graphite, is quite suitable for high temperatures provided that air is excluded. Heavy water is virtually eliminated by its low boiling point. Ordinary water, in spite of its low boiling point and rather high neutron capture, might be used as a combined moderator and coolant under special circumstances. A group of materials which may become increasingly important are the beryllium compounds, due to their high melting points and inertness.

CHOICE OF A REFLECTOR

We have so far considered only the reacting core of the pile, namely the coolant, the moderator and the barrier used for separating the fissionable material from the coolant. Various other components are required for a practical unit. First, the reacting core should be surrounded by a "reflector", which will serve to return to the reacting system a large fraction of the neutrons which would otherwise escape from the walls. The reflector should be composed of some material such as graphite which has low atomic weight and low neutron capture; the requirements are, in fact, much the same as for the moderator.

The reflector should be surrounded in turn by a layer of shielding to absorb the remaining neutrons and other radiations from the pile. The materials for this purpose should be good neutron absorbers and should be used in sufficient weights to absorb gamma radiations. Steel and concrete will probably be used in most cases as a result of their low cost and ease of fabrication.

NEUTRON ABSORBERS

Next, means must be provided for controlling the neutron reaction to maintain the desired power output. This can be accomplished by adjustable neutron absorbers, such as cadmium or boron rods, which are moved in or out of the reacting core by automatic control mechanisms. In addition, safety devices consisting of large neutron absorbers should be available for stopping the reaction rapidly in the event of any dangerous departure from normal operating conditions.

REPLENISHING FISSIONABLE MATERIAL

Equipment must be provided for removing spent fissionable material from the pile and replacing it with fresh material. These operations would necessarily be carried out within the shielding by remote control, due to the intense radioactivity from the

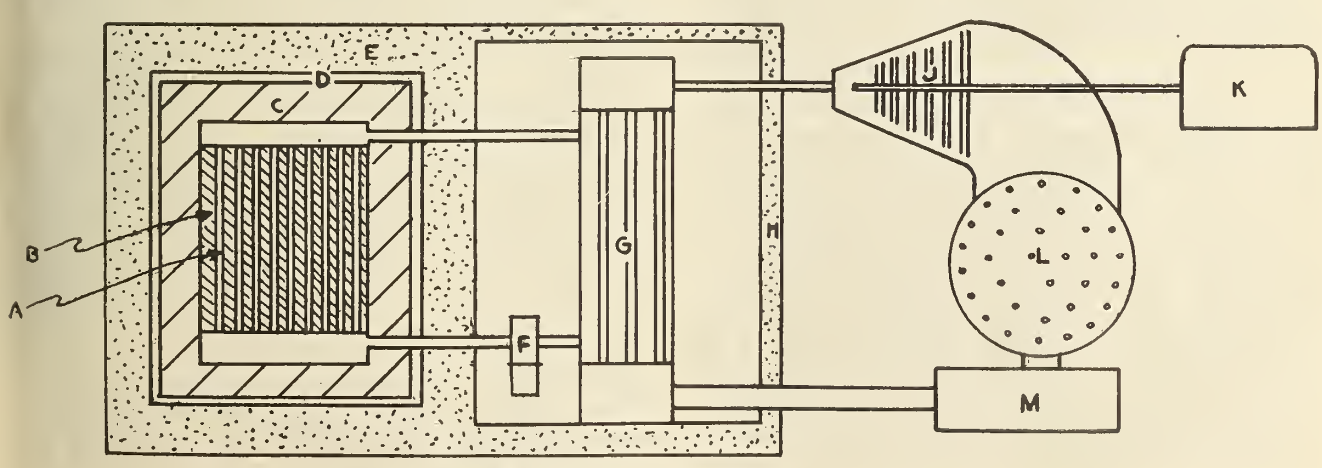

Fig. 1—Simplified hypothetical atomic pile power plant.

fission products. Finally, chemical processing equipment will be required for recovering fissionable material from the spent mixture and preparing the fission products for use or disposal.

A much simplified diagram of a hypothetical power plant of this type is shown in Fig. 1.

The fissile material is in the form of rods A, arranged in vertical holes in the block of moderator B. This reacting core is surrounded by the reflector C, the steel shell D and the heavy concrete shielding E. The molten metal coolant is forced by the pump F through cooling passages in the reacting core, and then through the heat exchanger G. The pump and heat exchanger are enclosed by the light concrete shield H. The working fluid for the power producing circuit is water which is heated to conventional steam temperatures in the heat exchanger G. The resulting steam drives the turbine J and the generator K, is condensed in L, and returned to the heat exchanger by pump M. Required but not shown in the diagram are the absorbers for control and emergency shut down, and the mechanical arrangements for renewing the fissionable material in the reacting core.

Fields of Application of Nuclear Energy

The preceding sections have outlined some of the considerations involved in producing power from primary and secondary piles. It is now appropriate to examine the general picture of nuclear energy to see what useful applications it may find in the visible future. For convenience, we will deal first with the power aspects of nuclear energy and postpone the discussion of other applications to the next section. It should be borne in mind, however, that many of these other applications arise from by-products of power production and may therefore contribute substantially toward operating costs.

The advantages of nuclear power are few in number but of extraordinary importance. We can state them simply as the very high ratio of energy production to fuel consumption, and the flexibility of control of energy production. The concentrated energy storage in nuclear fuels is well illustrated by the fact that U235 on fission yields approximately 3 million times the energy from the combustion of an equal weight of coal. The flexibility of control arises from the fact that energy may be released at any rate from zero to a level which results in destruction of the system merely by adjusting a small neutron absorber.

The disadvantages of nuclear power are numerous but not necessarily so decisive. Primary piles are very large units which can normally be built only in a few selected localities. Secondary piles are much more compact but require the use of enriched uranium, which is itself the product of elaborate physical and chemical processes. All chain reacting units require massive shields for protection of personnel from neutron and gamma radiations; the weight of this shielding would be of the order of tons for even the smallest power producing pile. All parts of the unit which contain radioactive materials require special design and elaborate operating precautions to avoid leakage of materials or radiation. The final and perhaps the most troublesome feature is the necessity of separating and disposing of the highly radioactive fission products from the uranium.

Our knowledge of the various factors is not yet sufficiently complete to give an accurate appraisal of the part nuclear energy will play in the future. Past experience suggests that nuclear energy will not cause a sudden revolution, but will be gradually introduced in specific instances where it is found to be the most economical solution. We can expect that the cost of nuclear energy will gradually decrease with further development so that the number of favorable situations will increase. However, there will probably always be fields where hydroelectric power, coal or oil provide the best solution.

MOST PROMISING APPLICATIONS

One of the large scale applications of nuclear power plants might be the industrial development of parts of the world where conventional fuels or hydroelectric power are not readily available. Since the transportation costs for nuclear fuel would be insignificant, such areas would be in virtually as favorable a power situation as the present industrial centres.

Another step might be the replacement of coal-fired boilers in the larger steam-electric power stations by nuclear reactors. Most industrial districts in Europe and many in the United States are now entirely dependent on coal for electric power. The steadily-rising costs of coal suggest that the time when such a change is economically desirable may not be too far distant. The conversion might be a particularly expensive undertaking in this instance, since much of the mechanical equipment and all of the distribution system could be retained.

The use of nuclear power plants does not seem to be so favorable where hydroélectric power is now available, as in most parts of Canada. Some saving may be possible by locating the power plant close to the load centre to avoid long transmission lines. Similarly, industries which require large amounts of electric power might find it advantageous to locate near established markets or transportation routes and construct a nuclear power plant rather than move to an isolated power site. Another important advantage in some industries might be the ability of nuclear power plants to supply heating and process steam directly in addition to electric power.

NOT SUITABLE FOR SMALL INSTALLATIONS

Very small nuclear power plants are unlikely to be used at all for normal purposes as long as other power sources are available at reasonable cost. Due to the critical size phenomenon, a certain minimum quantity of fissionable material is required for a reactor regardless of the power output. The value of the material is sufficiently high that the interest on the investment might greatly exceed the cost of the fuel consumed in a small reactor.

One of the least attractive applications of nuclear power at the moment is that of transportation. An exception may be made in the case of large naval craft, where weight-carrying capacity is adequate, and where infrequency of refuelling is of paramount importance. It is possible that nuclear power plants may be developed which are sufficiently small and rugged for use in railway locomotives. A more attractive course, if coal and oil were scarce, would probably be the electrification of the system with power supplied from central stations. There is no visible prospect of the development of plants sufficiently small or light for use in ordinary aircraft or motor vehicles. The possibility that pilotless aircraft using nuclear reactors with little or no shielding may be built cannot be discounted, but this is still well into the future.

COST OF COAL AND NUCLEAR POWER COMPARED

So far nothing specific has been said about the economic side of nuclear power production. It should be stressed at the outset that any estimates of costs which are made can be little more than intelligent guesses, due to the lack of actual experience in operating power producing piles. The uncertainties include not only the construction costs, but also the useful life and the cost of nuclear fuels on a commercial basis.

The only authoritative estimates now available are those prepared for the United Nations Atomic Energy Commission by members of the engineering staff of the Clinton Laboratories at Oak Ridge, and of the Monsanto Chemical Company. No details are given as to the type of pile considered nor of the assumptions made in estimating costs.

It is stated that a 75,000 kilowatt plant could be built in a normal locality in the eastern United States for $25 millions at current prices. On the assumption that the plant would operate at 100 per cent of capacity and that interest charges on the investment would be 3 per cent, the operating cost would be approximately 0.8 cents per kilowatt hour.

A coal-fired plant of the same capacity would cost $10 millions at current prices. The cost of bituminous coal of 13,500 B.T.U. is about $7 per ton delivered at a power plant in the eastern United States. Assuming again that the plant would operate at 100 per cent of capacity and that interest charges on the investment would be 3 per cent, the operating cost would be approximately 0.65 cents per kilowatt hour. Equality between coal and nuclear power plants would be reached if coal were to cost $10 per ton delivered.

The comment is made that the higher cost of nuclear power results principally from the larger investment, and the expected higher labor and supervision costs for the nuclear plant. Both the investment and the operating costs are likely to fall as standardization of design and construction take place and as the simplicity and safety of operation are improved.

Other Industrial Applications of Nuclear Energy

An obvious alternative application of nuclear energy is the direct employment of heat in industrial processes or heating systems. Serious difficulties will usually be encountered in isolating the material to be heated from radiation and from contamination by fission products. The possibility of attaining extremely high temperatures may eventually outweight the difficulties by making possible entirely new processes. For some time, however, utilization of thermal energy will probably be confined to recovery of waste heat from electric power generation, or to combined electric power and process steam production.

Before leaving this subject, some comment should be made on the possibilities of producing climatic changes by heat from nuclear energy. Many extravagant statements have been made in this regard, ranging from heating and lighting cities by atomic "suns" to turning our northern territories into orange groves. It is therefore well to consider the actual quantities of energy involved.

NO CLIMATIC CHANGES FORESEEN

Climatic conditions are determined mainly by solar radiation, which amounts to 3.5 million kilowatts of heat energy per square mile at the equator. The production of heat from nuclear fuels at this rate would require the consumption of slightly over 1 ton of pure fissionable material per square mile per year. Since nuclear fuels will probably cost tens of thousands of dollars per pound for some time to come, the cost of supplementing solar radiation over any large area is obviously rather high. It is true that cities might well be heated by nuclear energy, but this would probably be accomplished by more conventional means than suspending an atomic sun overhead. Not only would the latter scheme be somewhat extravagant of heat energy, but the gamma rays emitted would soon eliminate the inhabitants.

USES FOR RADIATION

The other great field of application of nuclear energy involves the use of the various types of radiation which can be produced. These radiations are similar to those which have been known for years through radium and X-rays, but are available on an enormously greater scale and at much lower cost than before. Gamma rays, similar to hard X-rays, are emitted on fission. The fission products are themselves radioactive and emit beta particles (high speed electrons) and gamma rays. In addition, surplus neutrons from fission may be used to produce synthetic radioactive materials by absorption in suitable substances inserted in a chain reacting pile. The radiations may thus be utilized in three ways: by direct exposure in the pile, by separating radioactive fission products from the uranium, or by preparing new radioactive materials from surplus pile neutrons. The last two methods enable use away from the pile, since the radioactive materials may be readily shipped in shielded containers to any destination. The last method is particularly useful since radioactive materials can be virtually "tailor-made" for the specific application.

These radioactive materials may be expected to find more and more uses in physics, chemistry, metallurgy, biology and medicine. Treatment of cancer, now carried out by the use of X-rays or radium, is expected to be greatly facilitated by new radioactive materials. Gamma radiations from suitable materials may be used as substitutes for X-ray equipment in clinical and industrial radiography, being particularly adaptable by virtue of the small size of the source. The destructive effect of radiation on living organisms may eventually be applied to water purification, sewage disposal and other sanitary problems. The ionization of air by small quantities of radioactive materials has been suggested as a means of reducing static electricity hazards in explosives plants and dusty locations. Long-lived radioactive materials in combination with suitable phosphors may eventually be used as cold light sources, requiring no power or maintenance.

RADIATION CHEMISTRY

Two new branches of chemistry, known as "tracer chemistry" and "radiation chemistry" are coming into prominence as a result of the ready availability of radioactive materials. The first is based on the fact that radioactive atoms of a given element are identical with normal atoms in their chemical behaviour. The radioactive atoms may be followed through any physical or chemical process by means of instruments sensitive to their radiations, and thus enable the course of the whole reaction to be traced. Knowledge of the way in which atoms transfer from one molecule to another or from one place to another is of great importance in research on diffusion, adsorption, corrosion, phase changes and many other processes. A few of the suggested applications of tracers to engineering problems are the study of the performance of distillation columns in the oil industry, the identification and location of minor constituents of alloys, the study of lubrication of moving parts, and the tracing of liquid and gas flows in hydro and aerodynamics. This list can probably be greatly expanded since the field is virtually untouched at the moment.

Radiation chemistry deals with the chemical reactions produced by radiation. This subject is still in too early a stage of development to predict any definite applications. However, it appears likely to be of interest in polymerization and cracking, in catalysis and in many other organic and inorganic processes. A subsidiary consideration is the change in physical properties of solids which result from exposure to radiation. Whether this may lead to the development of new and useful properties in familiar materials is a question for the future.

Nuclear Engineering

The preceding sections have been an attempt to show the part which this new energy source is likely to play in the industrial world. Before concluding, two aspects of nuclear energy will be mentioned which, it is hoped, will be of particular interest to engineers. The first of these will be a resume of the principal ways in which nuclear engineering differs from the more familiar branches of applied science; the second will be a brief summary of the development work which lies ahead before nuclear power is a reality.

The differences between equipment designed for use in nuclear reactors and for ordinary chemical and mechanical processes arise from two main considerations: first, the effects of neutrons and other radiations on structural materials, and second, the necessity of protecting personnel from these radiations. A third consideration which may arise eventually is that nuclear reactors afford a means of releasing energy at enormously greater rates and in much smaller volumes than in molecular reactions, so that much higher temperatures and temperature gradients may be encountered.

Effect of radiation on structural materials

Considering the effects of radiation on structural materials, we know that neutrons cause nuclear reactions with almost all elements, although the actual extent of the reaction varies very widely. Such reactions result (a) in loss of neutrons, (b) in production of radioactive isotopes of the material, (c) in production of heat in the material, (d) in chemical decomposition of the material, and (e) in changes in the physical properties of the material. Other radiations such as beta and gamma rays usually cause heat production only. Any or all of the above effects can be serious depending on the particular case. Thus, the nuclear designer must;

(a) Select materials which have sufficiently low neutron capture to avoid upsetting the reacting system.
(b) Select materials which produce only short-lived isotopes, which decay rapidly after the system is shut down, or else accept the fact that the part cannot be serviced.
(c) Provide auxiliary cooling systems for all parts where significant heat is produced.
(d) Avoid materials which undergo chemical decomposition, including most plastics, organic lubricants, etc.
(e) Use large safety factors in designing for structural strength, or carry out experimental work to determine whether any serious deterioration occurs.

In addition, the designer has the normal problems of heat transfer, thermal expansion, corrosion and so forth. Needless to say, many of these requirements are mutually conflicting and any actual reactor will represent an elaborate series of compromises.

Neutron capture of elements compared

Before leaving this subject it may be of interest to list the approximate slow neutron capture cross sections of a few common elements. These cross-sections as shown in Table I are given in " barns ", which, as mentioned in the first paper, indicate the relative probability of neutrons being absorbed in a given number of atoms of the material. The capture cross-sections for compounds may be obtained by simply adding the cross-sections of the individual atoms.

Table I

Slow Neutron Capture Cross-sections of Certain Common Elements Expressed in " Barns ".

Element	*Cross-Section*	*Element*	*Cross-Section*
Hydrogen	0.3	Chromium	3.
Deuterium	.001	Manganese	13.
Helium	0.0	Iron	3.
Lithium	60.	Nickel	4.
Beryllium	.01	Copper	4.
Boron	700.	Zinc	1.
Carbon	.005	Cadmium	2500.
Nitrogen	2.	Tin	0.7
Oxygen	.002	Antimony	5.
Sodium	0.5	Mercury	400.
Magnesium	0.4	Lead	0.2
Aluminum	0.2	Bismuth	.02
Silicon	0.3		

Without considering each element individually, it may be pointed out that the capture cross-sections vary widely, but that very few elements combine both low cross-sections and good structural properties. When some of the resulting possibilities are discarded on the basis of undesirable neutron reactions, it can be seen that the choice of materials left to the designer is small indeed.

Protection of personnel

The protection of personnel involves shielding from direct radiation and prevention of leakage of radioactive materials into the working areas. Both of these problems are fairly straightforward although their detailed solution may involve considerable effort. The shielding is usually of a composite type, with layers of water or other hydrogenous material to slow down the neutrons, layers of metal of fairly high capture cross section to absorb the neutrons, and finally a heavy layer of concrete or lead to absorb gamma radiation. The shielding itself, at least in the inner layers, requires cooling to remove the heat produced by absorption of radiation. Special arrangements are required at the charging and discharge openings, at pipe lines, and at control and power shafts to prevent leakage or radiation. The remaining problem, the prevention of leakage of radioactive gases and liquids, involves the use of valves, pumps and blowers especially designed for this service.

MANY PROBLEMS STILL TO BE SOLVED

Finally, let us consider the principal engineering development problems which must be solved before nuclear power can be produced commercially. First, a comprehensive programme must be undertaken for investigating the properties of materials for use in the proposed reactor, under working temperatures and radiation intensity. A programme of this nature requires that a working pile be available to produce the necessary radiation. Following this, a series of heat transfer investigations must be carried out for the most efficient design of the cooling system. Next, mechanical equipment must be developed for use in the reactor, which will operate for very long periods of time without requiring servicing. The equipment must be so arranged that the more complex mechanical parts do not become active, or alternatively that these may be removed and replaced by a new unit without opening the shielding. To repeat, the development of fluid handling equipment which allows no leakage of active material, is a very important requirement. Finally, chemical separation processes must be developed which will operate with a minimum loss of fissionable material or of recycled uranium, yet be reasonably simple and be capable of complete operation by remote control within shielding.

Conclusion

We may conclude by attempting to show some of the implications of our present status. First, it can be seen that the outstanding aspect of nuclear power development is the tremendous amount of work which remains to be accomplished. The effort involved in building up a complete set of facilities for the economical utilization of nuclear energy is probably nearly as great as that expended on the atomic bomb project during the war.

Next, it must be appreciated that we have in nuclear energy merely a new source of heat, which still requires the bulk of the equipment of a conventional steam power station for its conversion to electrical energy. This has both good and bad features. In areas where coal-fired steam power plants are now the main source of energy, such as England and many parts of the United States, conversion to nuclear fuels may require relatively few changes. The increasingly difficult coal situation may, in fact, make it desirable to convert while nuclear fuels are still quite expensive. However, in countries such as Canada where hydroelectric power is the principal source of electrical energy, the use of nuclear fuel would involve the construction of entirely new plants, and it will be generally true that nuclear fuel costs will have to fall to a low level before any extensive conversion takes place.

Again, there is the consideration that nuclear power plants will probably be most economical and most easily constructed in large sizes, say from 100,000 to 1,000,000 kw. Nuclear power plants will thus be largely confined to heavy load centres or extensive distribution networks.

PUBLIC OWNERSHIP ESSENTIAL

Last, but by no means least, we have the problem of controlling activities in the nuclear energy field. Since the fissionable materials required for power production are virtually the same as those used in atomic weapons, national interests will inevitably require the maintenance of rigid control until some really workable international agreement is put into effect. Even after the establishment of such an agreement, control measures will be required to prevent diversion of fissionable materials for illegal activities.

The upshot of this situation is that we are never likely to have free participation by private industry in all phases of nuclear energy. Future progress, as for example the development of "denatured" fissionable material which can be used for power production but not for atomic weapons, may permit free activities in some fields. However, the operation of primary piles and isotope separation plants is likely always to remain under federal or international control. It may be added that the expenditures involved in the construction and operation of these units are in any case likely to be too large for private enterprise.

In spite of all difficulties, it is felt that nuclear energy can be and should be exploited, for by so doing we can postpone for a very long time any fear of exhaustion of the world's power resources, and bring industrial power to areas now undeveloped.

THE SIXTY-FIRST ANNUAL GENERAL MEETING

Convened at Headquarters, Montreal, on January 30th, 1947, and adjourned to the Royal York Hotel, Toronto, Ontario, on Thursday, May 8th, 1947

The Sixty-First Annual General Meeting of The Engineering Institute of Canada was convened at Headquarters on Thursday, January 30th, 1947, at eight o'clock p.m., with Vice-President J. E. Armstrong in the chair.

The assistant general secretary having read the notice convening the meeting, the minutes of the Sixtieth Annual General Meeting were submitted, and on the motion of Huet Massue, seconded by D. W. Campbell, were taken as read and confirmed.

Appointment of Scrutineers

On the motion of R. S. Eadie, seconded by C. R. Wintermark, Messrs. Henri Gaudefroy, Bruce H. Johnston and H. S. Van Scoyoc, were appointed scrutineers to canvass the officers' ballot and report the results.

There being no other formal business, on the motion of G. W. Jarvis, seconded by Jacques Benoit, it was resolved that the meeting do adjourn to reconvene at the Royal York Hotel, Toronto, at nine thirty a.m. on the eighth day of May, nineteen hundred and forty-seven.

Adjourned General Meeting at the Royal York Hotel, Toronto, Ontario

The adjourned meeting convened at nine thirty a.m. on Thursday, May 8th, 1947, with President J. B. Hayes in the chair.

Nominating Committee—1947

The general secretary announced the membership of the Nominating Committee of the Institute for the year 1947 as follows:

Chairman: Stewart Young

Branch:	*Representative*
Border Cities	T. H. Jenkins
Calgary	P. F. Peele
Cape Breton	J. H. Fraser
Cornwall	W. P. Nesbitt
Edmonton	C. W. Carry
Halifax	A. E. Flynn
Hamilton	Alex. Love
Kingston	D. S. Ellis
Kootenay	Ernest Mason
Lakehead	W. L. Bird
Lethbridge	G. S. Brown
London	J. H. Johnson
Moncton	A. R. Bennett
Montreal	J. J. H. Miller
Niagara Peninsula	C. G. Cline
Ottawa	E. G. Cameron
Peterborough	W. T. Fanjoy
Quebec	J. O. Martineau
Saguenay	W. F. Campbell
St. Maurice Valley	A. S. Holder
Saint John	K. V. Cox
Sarnia	J. W. MacDonald
Saskatchewan	A. P. Linton
Sault Ste. Marie	R. A. Campbell
Toronto	A. E. Berry
Vancouver	A. Peebles
Victoria	J. C. MacDonald
Winnipeg	C. P. Haltalin

Honorary Memberships

The general secretary reported that the following had been elected to honorary membership in the Institute and that certificates would be presented at the annual dinner:

Ernest Brown, D.Eng., Former Dean and Emeritus Professor of Civil Engineering, McGill University, Montreal, Que.

Percy Dunsheath, C.B.E., M.A., D.Sc. (Eng.), Past-President, Institution of Electrical Engineers, Chief Engineer, W. T. Henley's Telegraph Works Co. Ltd., Hatton Gardens, London, E.C.1.

Chalmers Jack Mackenzie, C.M.G., B.E., M.C.E., D.Sc., LL.D., President, National Research Council of Canada, Ottawa, Ontario.

Frederic Henry Sexton, B.Sc., LL.D., President, Nova Scotia Technical College, Halifax, N.S.

Award of Medals and Prizes

The general secretary announced the awards of the various medals and prizes of the Institute as follows, stating that the formal presentation of these distinctions would be made at the annual dinner of the Institute the following evening:

Sir John Kennedy Medal—"A recognition of outstanding merit in the profession or of noteworthy contribution to the science of engineering or to the benefit of the Institute." To—Lorne A. Campbell, M.E.I.C., Trail, British Columbia.

Julian C. Smith Medals—"For achievement in the development of Canada." To—Charles Camsell, M.E.I.C., Ottawa, Ontario, and John Bow Challies, M.E.I.C., Montreal, Quebec.

Gzowski Medal—To—J. G. G. Kerry, M.E.I.C., for his paper "The Winter Temperature Cycles of the St. Lawrence Waters."

Duggan Medal and Prize—To—A. K. Leuthold, M.E.I.C., for his paper "The Application of the Gas Turbine to Railway Locomotives."

Leonard Medal—To—George Gedge, C.I.M.M., for his paper "Safety in the Handling of Explosives at the Hollinger Mine."'

Plummer Medal—To—W. J. Tomlinson, M.E.I.C., for his paper "Modern Methods of Conditioning Boiler Water Externally."

Keefer Medal—To—R. M. Hardy, M.E.I.C., and E. D'Appolonia, M.E.I.C., for their paper "Permanently Frozen Ground and Foundation Design."

Ross Medal—To—A. B. Hunt, M.E.I.C., for his paper "The Future of Radio Communications in Canada."

Students and Juniors Prize

H. N. Ruttan Prize—(Western Provinces)—E. M. Scott, S.E.I.C., for his paper "The Operation and Construction of the Modern Oil Circuit Breaker."

Report of Council, Report of Finance Committee, Financial Statement and Treasurer's Report

On the motion of A. R. Hannaford, seconded by I. Brouillet, it was resolved that the report of Council, the report of the Finance Committee, the Financial Statement and the Treasurer's report, be accepted and approved.

1.

2.

THE AIRCRAFT GAS TURBINE SESSIONS

Above—Head table guests at the luncheon: A/VM A. L. James, Air Member for Technical Services, Ottawa; H. Birchard Taylor, Philadelphia; the speaker, Air Commodore Frank Whittle, C.B., C.B.E., F.R.S.; Chairman C. E. Sisson, Toronto; R. G. Standerwick, Lynn, Mass.; J. G. G. Kerry, Port Hope; C. E. Davies, Secretary, A.S.M.E. Photos 2, 3 and 4 show A/C Whittle, guest chairman A/VM James and Prof. T. R. Loudon of Toronto at the Jet Propulsion Technical Session which preceded the luncheon.

3.

5.

4.

6.

ATOMIC ENERGY

The opening luncheon, Thursday May 8th, and the afternoon technical session were devoted to Atomic Energy, the outstanding technical achievement of the Second World War. In 5, K. F. Tupper, director of the Engineering Division at Chalk River deals with "Engineering Nucleonics". Photo 6 shows C. H. Jackson, chief engineer, Special Projects Dept., Defence Industries Ltd., Montreal, telling of the building of the Chalk River plant. Photo 7, from a balcony of the ballroom, shows Prof. R. F. Legget, Toronto, introducing the luncheon speaker, Gen. A. G. L. McNaughton, C.H., C.B., C.M.G., D.S.O., who is shown in the 8th picture delivering his address which dealt with "International Control of Atomic Energy".

7.

8.

Reports of Committees

On the motion of Charles Miller, seconded by A. J. S. Taunton, it was resolved that the reports of the following committees be taken as read and accepted: Legislation, Employment and Rehabilitation Service, Board of Examiners, Publication, Membership, Industrial Relations, Prairie Water Problems, Community Planning, Papers, Library and House, Engineer in the Civil Service, The Young Engineer, Employment Conditions, Professional Interests, Canadian Chamber of Commerce, Canadian Standards Association, Canadian Radio Technical Planning Board.

Branch Reports

On the motion of I. S. Patterson, seconded by A. Sandilands, it was resolved that the reports of the various branches be taken as read and approved.

Election of Officers

The general secretary read the report of the scrutineers appointed to canvass the officers' ballot for the year 1947 as follows:

President: L. F. Grant, Kingston, Ont.

Vice-Presidents:

Zone A (Western Provinces), S. G. Coultis, Calgary
Zone B (Province of Ontario), W. L. Saunders, Ottawa
Zone C (Province of Quebec), R. S. Eadie, Montreal

Councillors:

Vancouver Branch	T. V. Berry
Kootenay Branch	S. C. Montgomery
Edmonton Branch	F. R. Burfield
Saskatchewan Branch	N. B. Hutcheon
Lakehead Branch	S. T. McCavour
Border Cities Branch	A. H. MacQuarrie
London Branch	V. A. McKillop
Toronto Branch	C. F. Morrison
Ottawa Branch	J. H. Irvine
Kingston Branch	J. R. Carter
Cornwall Branch	B. deHueck
Montreal Branch	J. A. Beauchemin
	K. G. Cameron
	C. E. Gelinas
St. Maurice Valley Branch	Viggo Jepsen
Saguenay Branch	W. J. Thomson
Saint John Branch	C. D. McAllister
Halifax Branch	L. E. Mitchell

On the motion of A. J. S. Taunton, seconded by A. D. Harris, it was resolved that the reports of the scrutineers be adopted, that the scrutineers be thanked for their services in preparing the report, and that the ballot papers be destroyed.

The president announced that the newly elected officers would be inducted at the annual dinner of the Institute the following evening.

New Business

A motion was presented by Mr. Self (Toronto) proposing that the Institute should canvass the individual members of the organization with regard to whether or not the Institute should support the new Canadian Council of Engineers and Scientists. Mr. Dobson (Toronto) seconded the motion. The president asked Mr. Stirling (Montreal) chairman of the Committee on Professional Interests, if he would care to reply to Mr. Self's remarks. Mr. Stirling reminded the meeting that this subject had been canvassed thoroughly some time ago by his committee, at the time it prepared its statement of co-operation with sister societies. The statement had been submitted to the executive of every branch in Canada, and to every councillor and to every past-president. It had also been discussed before several Council meetings. This canvass did not reveal a single negative opinion. Subsequently the statement was approved by Council. Under these circumstances he was of the opinion that a vote for the motion was a vote of lack of confidence in the Council of the Institute.

Mr. Hannaford (Hamilton) and Mr. Dunbar (Hamilton) were of the opinion that the councillors in voting in favour of the statement had acted in accordance with the wishes of their branches. They felt that Mr. Self's motion now would in essence be a vote of lack of confidence in Council.

The general secretary reported that this subject had been discussed for over an hour at the meeting of Council which took place the day previously. The discussion had indicated that many members were unfamiliar with the details and had not seen all the material that had been published on it. Finally it had been agreed that the committee should re-examine the situation and if it appeared desirable, again circularize the membership with the full story.

Mr. Stevens (Winnipeg) stated that the executive of his branch had passed a resolution on this subject which had been forwarded to Council, but at the meeting of Council on the day previous he thought the situation had been clarified considerably. He did not think that a national body such as the Institute could adopt a sound policy by submitting such matters to a plebiscite. He did not think one could have a satisfactory organization if Council were required constantly to refer matters of policy to the entire membership for opinion. Therefore, he supported Mr. Stirling's belief that this would be a motion of lack of confidence. Mr. Heartz (Montreal) also supported this opinion.

President-elect Grant drew attention to the possible difference of interpretation of the word "support" as used in Mr. Self's motion. He pointed out that the Institute was always ready to support any organization in a cooperative endeavour that was for the good of the profession or other worthy causes. If Mr. Self intended the word to mean the Institute should join the new Council, then it was an altogether different matter.

Mr. Sisson (Toronto) pointed out that in the discussion it was apparent that Mr. Self and his seconder, Mr. Dobson, held different ideas as to how the membership of the Institute should be canvassed. Mr. Self had asked for an individual canvass, whereas Mr. Dobson had recommended that it be handled through the branches. Mr. Self replied that it was immaterial to him how it was carried out, and that either method would be satisfactory.

The president restated the motion as follows: That the individual members of the Institute be canvassed either directly through headquarters, or through the individual branches, in order to ascertain their opinion as to support and collaboration with the Council of Engineers and Scientists. Mr. Self agreed to this wording, whereupon the president put the motion which was defeated, only ten members supporting it.

Retiring President's Address

In accordance with established custom, the president delivered his retiring address, which appears in full on page 286 of this issue of the *Journal*.

Vote of Thanks to the Toronto Branch

On the motion of A. E. Flynn, seconded by R. C. Flitton, it was unanimously resolved that a hearty vote of thanks be extended to the officers and members of the Toronto Branch in recognition of their hospitality and activity in connection with the holding of the Sixty-First Annual General Meeting.

Vote of Thanks to Retiring Officers

It was moved by Past-President Cleveland that a hearty vote of thanks be tendered to the retiring president and to the able councillors who had supported him throughout the year.

He observed that the president had brought to his high office an enthusiasm and personality which were wholly refreshing. Those who had followed the president's extensive travels in Canada and to the Old Country had some realization of the sacrifice he had made on behalf of the Institute.

He concluded by asking the meeting to join with him in extending this vote of thanks. The motion was received with applause and the president acknowledged it on behalf of himself and his fellow workers.

The meeting adjourned at eleven forty-five a.m.

THE ANNUAL MEETING

The Diamond Jubilee Meeting was indeed a jubilee. The activities carried out in accordance with the programme and those developed on the spot by the delegates indicated clearly that 60 years in the life of a society brings it only to its prime—certainly not to its dotage. It is doubtful if a more profitable and enjoyable meeting could be devised.

Toronto made a new record for attendancee, the registration just falling short of a 1000 by 40. Doubtless there were many at various sessions who did not register, so that in fact the attendance was well over that figure. For the first luncheon there were 570, the second luncheon, 617 and for the banquet, 745. The smoker drew 405.

The innovation of holding the meeting in the Spring instead of the Winter was well received, judging by the full attendance at all functions. It is likely that future meetings will be held about the same time, unless special circumstances warrant a change.

Distinguished Guests

Again the Institute was fortunate in having a number of distinguished engineers participate in the programme, some of them from other parts of the world. Outstanding in this group was Air Commodore Whittle of jet propulsion fame, who made the trip to Toronto solely for this purpose. After a visit to the United States last December to receive the Guggenheim Medal, he suffered a severe illness and was in hospital at Washington for many weeks. Instead of returning to England for his leave and convalescence he remained on this side to fulfil his engagement to the Institute. It was fortunate for the Institute that he did so because his contribution was outstanding. His expert knowledge of his subject and his charming personality were the highlights of the meeting.

From the States we had many representatives: R. G. Standerwick of the General Electric Co., Lynn, Mass., was one of the principal discussors of Whittle's paper, and as well introduced the Air Commodore for his luncheon address—a remarkably skillful build-up both for the speaker and for his subject. We were also honoured by the presence of Eugene W. O'Brien, of Atlanta, Georgia, president of the American Society of Mechanical Engineers, C. E. Davies, of New York, secretary of the same society, and H. H. Henline, of New York, national secretary of the American Institute of Electrical Engineers. The Institute was also glad to have as its guests Evelyn Fenwick, of the Institution of Electrical Engineers, Great Britain, who was returning to his home in New Zealand, and Capt. R. C. Petter, of London, England, a member of the Council of the British Engineers Association, and a member of the Institutions of Mechanical Engineers and Marine Engineers.

Council Meeting

So far as can be discovered no previous meeting of Council has shown an attendance as representative of the branches as the one held all day Wednesday, May the 7th. Twenty-two branches were counted in the roll call including Vancouver, B.C., and Sydney, N.S. The total attendance was sixty-six.

The retiring president J. B. Hayes combined in nice proportions the ability to get the business completed and to draw out discussions from everyone who had anything to contribute. For part of the afternoon session he asked vice-president C. E. Sisson to preside.

The business of the meeting will be reported later.

The President's Dinner

As usual this turned out to be one of the pleasantest events on the programme. It is the occasion when the retiring president gathers around him the officers of the Institute and other advisers who have helped him throughout his term of office. It is his "thank you" to them for services rendered. It usually follows the annual meeting of council.

The custom has grown of asking each past-president to make a speech—of very short duration. Always these are gems, and it is regrettable that the whole membership could not hear them. These senior statesmen have not lost their cunning in such matters, nor their sense of humor. In all there were seventy-six present.

Exhibits

Two exhibitions were features of the programme—one shown by the National Research Council, and the other by members of the Institute—an arts and crafts show. Both were excellent and added much to the interest and pleasure of the meeting.

The arts and crafts exhibition was an innovation. After many years of "toying" with the idea it was finally put on the programme. Its success indicates that it should be a frequent and perhaps annual event. It is evident that engineers have many talents, not normally considered a part of engineering. Included were oil paintings, water colors, pastels, photographs, ship and locomotive models, instruments, beaten metal work, and so on—and all of it good. The exhibition itself was arranged excellently—another tribute to the engineers.

The National Research Council exhibit, though small, was of unusual interest. It divided generally into two sections—one made up of samples of German electrical equipment and the other including several devices developed by the Council. Personnel from the Council were on hand to explain the operation of the equipment and considerable interest was evidenced by the engineers and their guests. Among the devices

ARTS AND CRAFTS EXHIBIT

A highlight of the meeting was the excellent exhibit of painting and other hobby work by Institute members. Mr. Phil Croft was the committee chairman.

N.R.C. TECHNICAL EXHIBIT

from the Council was a recently developed transmission line fault locator which was of great interest to those specializing in this field of electrical engineering. Of more general interest was the radar distance indicator which enables the pilot of an aircraft to determine his distance from one or more preselected points and which represents only one of the many varied uses to which radar can be applied in the operation of ships and aircraft.

The exhibit was another of several features which all contributed to the success of the Toronto meeting. The Institute is indebted to the officers and personnel of the National Research Council for their participation.

Another new endeavour was the screen set up by the Peterborough Branch to show something of the branch's activity, through copies of notices of meetings. It was both interesting and informative and doubtless gave officers of other branches some new ideas for their own programmes. The records of this branch have been preserved by a succession of secretaries to whom the credit is due for this interesting panel.

Students Conference

Once again the Institute invited each university to send a delegate to the Student Conference. All eleven institutions where engineering is taught were represented in addition to which there were several observers from university student bodies, from the teaching staff, from industry, and from sister societies.

The conference was held on Saturday the 10th from 10 a.m. to 6.30 p.m., with the new chairman of the Committee on the Training and Welfare of the Young Engineer, G. R. Langley, chief engineer of the Canadian General Electric Co., Peterboro, presiding.

Subsequently the resolutions of the conference will be published. In the meantime it is interesting to note that it was agreed unanimously that the conference should become a fixed annual event in the

THE ANNUAL BANQUET

Dr. C. J. Mackenzie, the dinner speaker, had some serious thoughts to leave with the engineers. Eugene O'Brien, Mrs. J. B. Hayes, Gen. McNaughton, and A/C Whittle appear to be listening carefully to every word.

Above—Charles Camsell, Ottawa, receives the Julian C. Smith Medal "for achievement in the development of Canada".

Below—The Plummer Medal was awarded to W. J. Tomlinson, Montreal.

Dr. Mackenzie receives the certificate of honorary membership in the Institute. His sponsor was Dr. K. M. Cameron of Ottawa who stands behind Eugene O'Brien and Mrs. J. B. Hayes.

President Hayes presents the Keefer Medal to R. M. Hardy, Edmonton.

Dr. E. A. Cleveland standing between President Hayes and Dr. F. H. Sexton sponsors Dr. Sexton for honorary membership in the Institute.

Right—Dr. Ernest Brown, Prof. Emeritus of McGill University, is sponsored for honorary membership by Dr. de Gaspé Beaubien. Seated are Dr. Camsell, Mrs. Frank Whittle and Dr. Mackenzie.

AT THE PRESIDENT'S DINNER

Above—Head Table guests enjoying a remark by Dr. E. A. Cleveland, Vancouver. General Secretary Austin Wright; Eugene W. O'Brien, New York, President, A.S.M.E.; and the host, President Hayes of Halifax in a characteristic pose.

Past President C. R. Young, Dean of the Faculty of Applied Science and Engineering, University of Toronto; T. H. Hogg also a past president, is on his left.

Above—Past Presidents F. P. Shearwood, Montreal; Dr. F. A. Gaby, Toronto; and Dr. C. J. Mackenzie, President of the National Research Council.

Dr. Mackenzie with Dr. Gaby and Past President K. M. Cameron of Ottawa at his right and left respectively.

annual meeting programme, and that a single day does not provide adequate opportunity to complete the business.

The delegates were as follows: University of British Columbia, Ronald D. Grantham; University of Alberta, R. A. Spencer; University of Saskatchewan, E. Ross Walsh; University of Manitoba, R. W. McLennan; University of Toronto, William A. MacDonald; (Observers), J. R. A. Walker, C. W. Daniel; Queen's University, J. S. Dalziel; (Observer), Norman Simmons; Representing Queen's Summer Session, J. G. S. Billingsley; McGill University, E. A. Gauthier; Ecole Polytechnique, Gaetan Ducharme; Laval University, Maurice Lavallee; University of New Brunswick, John W. Holmes; Nova Scotia Technical College, F. B. Schafheitlin.

Conference of Branch Officers

On Thursday evening a branch conference was held at which sixteen branches were represented. Vice-President C. E. Sisson presided with the following in attendance: E. K. Cumming, Edmonton; F. R. Burfield, Lethbridge; J. M. Patton, Regina; D. M. Stephens and R. T. Harland, Winnipeg; F. F. Walsh, Sarnia; A. D. Harris and G. W. Lusby, Windsor; F. R. Pope and A. R. T. Hailey, Peterborough; J. R. Dunbar, E. G. Wyckoff and L. C. Sentance, Hamilton; R. F. Legget and D. G. Geiger, Toronto; G. R. Turner, Ottawa; D. Ross-Ross, Cornwall; J. M. Crawford and R. N. Coke, Montreal; P. A. Dupuis and R. Desjardins, Quebec; V. Jepsen and W. R. Mackay, St. Maurice Valley; E. C. O'Leary, Halifax; S. G. Naish, Sydney.

A fuller account of the business of the session will appear in a later issue after the minutes have been circulated, although it might be noted here that the meeting agreed that a similar conference should be held every year.

Ontario Division Meets

History was made when the first meeting of the newly formed Ontario Division was held on Saturday morning. It opened under the provisional chairmanship of C. E. Sisson of Toronto. Elections were held immediately and W. R. Manock of Fort Erie was made chairman, J. R. Dunbar, of Hamilton, vice-chairman, and E. R. Graydon, of Toronto, secretary-treasurer.

At the time of going to press the minutes were not complete, but a complete report will appear in the next issue.

Joint A.S.M.E.-E.I.C. Committee

This committee endeavours to meet twice a year to discuss ways and means of promoting more co-operation between the members of both societies in Canada and the United States. This year the meeting took place during the course of the annual meeting and reviewed past performances and prepared for the future.

In 1946 the Institute participated in the A.S.M.E. summer meeting held in Detroit, and for 1947 arrangements have been made for joint sessions during the summer meeting to be held in Chicago. Also efforts are being made to have the Americans participate in the Institute's 1948 annual meeting which will be held in Banff in the month of June.

In attendance, representing A.S.M.E., were Eugene W. O'Brien, of Atlanta, Georgia, president; Professor S. R. Beitler, of Ohio State University, vice-president of the society; C. E. Davies, secretary, and Fred Truman, of Toronto, chairman of the Ontario section. Representing the Institute, John G. Hall and Dr. O. W. Ellis, both of Toronto, and the general secretary.

Papers to Be Published

It is planned to print in the *Journal,* all papers and addresses, thus it becomes unnecessary to give any description in the general account. The programme throughout was of an extremely high character and members who were not at the meeting may look forward with pleasurable anticipation to reading the material as the paper supply permits its publication.

Muriel's Room

"Muriel's Room" has become an institution within an institution and serves the very desirable purpose of keeping members and guests together to renew old acquaintances and lay the foundations of new friendships. In Toronto this year 34 industries co-operated in this now thoroughly entrenched custom and their reception of members and guests left little to be desired. The institute acknowledges its debt to the industries and their committee composed of chairman Cy. N. Danks, Canadian Ingersoll Rand Limited; Col. Geo. W. Beecroft, Geo. W. Beecroft Co.; and Paul W. Doddridge, Canadian General Electric Co.

SATURDAY CONFERENCES

Top—The student delegates met for a full day on Saturday. The discussion, directed by the new chairman of the Committee for the Welfare of the Young Engineer, brought about an interesting and informative exchange of ideas. Minutes are expected to be published in a forthcoming issue of the *Journal*.

Left—The first meeting of officers of the recently inaugurated Ontario Division.

Right—Lt. Col. Grant, E.I.C. President and retiring chairman of the "Young Engineer" Committee, Dr. G. R. Langley and the General Secretary.

NON-TECHNICAL ACTIVITIES

As the photos at left and below left illustrate, the Thursday evening smoker provided a measure of relaxation.

Below—the Publicity Committee. Left to right, Herb. Todgham, Prof. Mark Huggins (chairman), Jim Stanners, Jim Brown.

ANNUAL BANQUET AND DANCE
(right and below)

Above—Retiring Asst. Gen. Secretary Louis Trudel with Mrs. Trudel, M. Barry Watson and Mrs. Watson; Lt. Col. T. M. Medland, director of public relations of the Association of Professional Engineers of Ontario; Mrs. McCaffrey, Col. W. R. McCaffrey and Mrs. Medland.

Above—(left to right)—Representatives from Halifax. G. J. Currie, W. W. Downie, the late S. W. Gray and E. C. O'Leary, with Mrs. Currie, Mrs. O'Leary and Mrs. Downie.

Below—A Toronto group enjoying the hospitality of "Muriel's Room". Mr. and Mrs. C. P. Disney, Mr. and Mrs. R. W. Teagle and Mr. and Mrs. Bob Hewitt.

Above—Chairman A. D. Harris of Border Cities Branch (centre), with a party of friends.

Right—l. to r.—J. M. Millman and Mrs. Millman; Mrs. Morrison and Prof. Carson Morrison, all of Toronto; A. B. Hunt, Montreal, N. B. Hutcheon, Saskatoon; Mrs. A. D. McKinney, Mrs. C. W. Bell and Mr. C. W. Bell, Toronto.

Left—At the Friday luncheon—l. to r., Mrs. R. G. Standerwick, Mrs. E. A. Allcut, Mrs. C. R. Young, and Mrs. Frank Whittle.

Right—Student delegates with Institute officers at the Friday Luncheon—Past President J. B. Hayes; N. D. Simmons (Queen's University), E. A. Cross, Toronto; R. D. Grantham (University of B.C.); Dr. deGaspé Beaubien, Montreal; Maurice Lavalée (Laval University); Dr. K. M. Cameron, Ottawa; R. W. McLennan (University of Manitoba).

Above—Col. Davies, Capt. R. C. Petter, London, Eng., Dr. Mackenzie and Prof. Loudon exchanging technical (?) opinions.

Right—Chairman Cy. Danks and his committee with their invitation card to Muriel's Room.

ADDRESS OF THE RETIRING PRESIDENT

J. B. HAYES, M.E.I.C.

Delivered before the Sixty-first Annual General and Professional Meeting of The Engineering Institute of Canada, at Toronto, on May 8th, 1947

When I was honoured by being elected President of the Institute I appreciated the opportunities that go with the office, but I was by no means fully aware of the experience that would be mine. Perhaps the outstanding impression is the wider knowledge that I have obtained of the workings of our Institute and the enhanced respect that I have for the members of our profession. There is nothing more past than a past president of The Engineering Institute of Canada and as I approach that position I have a disturbing opinion that my personal gain has been far in excess of anything I have been able to do for the Institute.

On assuming office I subjected myself to a bit of self-analysis to determine which of my outstanding talents could best be applied to the benefit of the Institute during my term of office. The result was devastating because, instead of discovering which talent could be brought into play, I had to admit that I had little if any talent to contribute. I finally came to the conclusion that I might form a thread of contact on which to draw together the pearls of the Branches that make up our organization, by visiting all branches and meeting the engineers from coast to coast. This was an ambitious and delightful programme. I have run into a serious handicap in that I have been swamped with new friends so that I have found that it was impossible to identify and remember them all. To make matters worse, trained in the Public Utility business to show no discrimination, I scarcely dare recognize people whom I happen to know when by all the rules of the game I should know their neighbour. This I say at the start, because it will explain that any apparent " high hat " is not real.

Two new branches were inaugurated during the past year, the Kootenay Branch at Trail, B.C., and the Cornwall Branch in Ontario. These functions proved most stimulating and afford an excellent example of the kind of help that has been given me during my term of office by everybody I have met. At Trail there were representatives from branches as wide-spread as Halifax and Victoria and the hospitality and enthusiasm of the engineers in that vicinity should stimulate interest in the future of our profession. In short, it would be impossible to equal anywhere the hospitality and warmth of our reception.

Then in the fall, at Cornwall, we were received with greater enthusiasm than anywhere else on our trip. This may sound like impossible English, but when the King's English gets in my way, God help the King's English. At Cornwall, four of the six vice-presidents of the Institute made it their business to be present, and we were crusty with councillors, past-presidents, chairmen of branches and other distinguished members of the Institute. The way these two branches started off augurs well for their future success.

Subscriptions to the Harry F. Bennett Memorial Fund for the assistance of university engineering students have reached the desired quota, and the fund has already started to function. It was a pleasure to speak of this new line of activity to engineering students.

Our efforts to raise the standard of engineers' pay have had material success.

During part of my trip across this country my time-table conflicted with the work at some colleges, but I was able to speak to eleven of them. All these visits were inspiring and it is particularly pleasing to record the work done by returned service men who are studying engineering. These young men know what they are after and propose to get it without any foolishness. The deans of engineering where I was not privileged to visit, tell me the same story of the very good work being done there by returned men. Many of them suffer a handicap in that their preliminary training was not fully adequate, and they require, and are receiving, special attention from their instructors. At the moment, engineering education may be the greatest problem that faces our profession in Canada—and indeed all over the engineering world.

Austin Wright and I represented Canadian engineers at the Commonwealth conference in England, as two of ten representatives from the Overseas Dominions and India and as guests of the three senior institutes in Britain. We worked hard and played hard and, in my opinion, achieved constructive results.

From a first impression of despair at the condition of the Old Country, experience rapidly changed one's idea from despair to depression—to sympathy—to admiration—and to confidence in the future of that sorely-tried Country. In England, as in Canada, your President was received with great courtesy and consideration. No wish on our part could be expressed that was not fulfilled, and we were given a unique opportunity to see the engineering and scientific progress of the British laboratories, as well as glimpses of the remarkable work that in a large part stemmed from the British scientists' efforts to produce devices which contributed greatly to the successful conclusion of the war.

We Canadians had a chance to explain our close association with the great Republic to the south of us, and found a ready understanding on the part of the leaders of British engineering of the necessity of maintaining these contacts both for our sake and for the sake of the Old Country.

The meeting of members of our Institute residing in England was a unique affair, and if a similar engineering conference takes place in the future, I am satisfied that the meeting should be repeated.

The actual direction of the affairs of the Institute is necessarily centered around head office, and I pay a ready tribute to the quality of our general secretary and his staff. The Council of the Institute is about the most democratic body I ever saw, and in order to arrive at the best solution to our problems the finer shades of parliamentary procedure are forgotten. A council meeting is, however, a somewhat ponderous performance and in the interval between such meetings a custom has arisen to refer matters to our finance committee. I may be nistaken but it seems to me that the finance ommittee has evolved in part into an executive ommittee of Council. This has worked very well, argely because of the extremely high-grade personnel on the finance committee. I am a little loubtful, however, if it is the wish of the Institute o carry this development much further.

It is not possible to select particular committees or honourable mention, but if you will permit me o group them all together for a blanket tribute, I lo that without restraint. I do not know all of the vork done by the Committees, but I know enough o recognize and appreciate the debt that our membership owes to them.

Many people across Canada share in interesting phases of Canadian industry, particularly the production of basic goods from raw materials. Those that I have seen range all the way from steel, aluminum, lead and zinc to rock wool, powdered eggs and Nylon thread. In addition, of course, we saw manufacturing processes of varying sorts. It nay be almost impossible for one not given the advantages that have fallen to my lot in the last year, to appreciate the strength of our country. It seems that the greatest weakness we have is inherent in ourselves. These paralyzing stoppages of vork in the lumber industry in British Columbia; n the steel production in various parts of Canada; and at this moment, in the production of coal in the Maritime Provinces, are detrimental almost beyond one's power of description. However, this is a challenge that comes directly to the feet of the engineer and if our firm and concentrated efforts can be applied to increase production in our country, we ought to be able to exert a profound influence for good.

The Institute will be on more sound ground in the future than it has been in the past because of the approval, by an overwhelming majority of our members, of an increase in dues. This will enable us to expand and improve our services to our membership in various respects.

After we have written and talked about our professional problems and our professional progress and our achievements, there is still another field that is of great importance. Life is broader than logic. To our mechanical skills we must add a quality of personality which is extremely hard to define. I suggest, with great humbleness, that the development of personal responsibility and the introduction of something of one's own spirit in the work that comes to our hands will add to and round out the work we professional men are called upon to do. This personal responsibility might properly be extended to our activities as members and officers of The Engineering Institute of Canada, so that this Institute, which is growing in strength every month, can go forward to even greater successes.

Above left—J. B. Hayes of Halifax, the retiring president, addresses the Sixty-first Annual General Meeting, with the incoming president, Lieut.-Col. L. F. Grant of Kingston on his right, and General Secretary L. Austin Wright on his left.

Above right—The Friday afternoon technical session. C. E. Sisson, Toronto, introduces one of the speakers with (left to right) Lesslie R. Thomson (Ottawa), Dean C. R. Young (Toronto), and H. Birchard Taylor, President of the Cramp Shipbuilding Company of Philadelphia, Pa.

ANNOUNCEMENT

The incoming council of the Institute at its first meeting, held in Toronto on Friday, May 9th, voted to accept with pleasure the invitation of the Alberta Branches to convene the 1948 annual meeting at the Banff Springs Hotel in the first week of June.

From Month to Month

News of the Institute and other Societies, Comments and Correspondence, Elections and Transfers

SEE PAGES 289 TO 296

Attention is drawn to the minutes of the annual meeting of Council and the annual business meeting of the Institute on pages 289 to 296. Portions of these minutes deal with Institute policy in relationship to other societies. It is believed many members will find them interesting and informative.

APPOINTMENT OF ASSISTANT TO THE GENERAL SECRETARY

On the recommendation of the finance committee, the Council have unanimously approved the appointment of W. Douglas Laird, B.Sc. (C.E.), M.E.I.C., P. Eng., as assistant to the General Secretary, the appointment to be effective May 7th. This position was formerly held by Louis Trudel for a period of eight years.

W. D. Laird, M.E.I.C.

Mr. Laird was graduated in civil engineeering (1940) from the University of Manitoba. Coming to Montreal he joined the Shawinigan Engineering Company, and in December of 1940 was appointed to an R. C. A. F. commission in the Aero Engineers branch. Following the course at the Service Engineering School in Montreal he served at A.F.H.Q., Ottawa, Western Air Command and Alaska. He was seconded to the U.S. Navy for courses in Aero Engines at Massachusetts Institute of Technology and Pratt and Whitney, Hartford, Conn., completing his service career as test engineer with the Cold Weather Flight of the R.C.A.F.

Following discharge Mr. Laird took up gas turbine research with Turbo Research Limited at the Cold Test Station in Winnipeg. In July 1946 he returned to Montreal as representative of the Technical Information Service of the Department of Reconstruction and Supply which position he held until his appointment as assistant.

At Manitoba he won Isbister Scholarships in his first four years and the scholarship of the Association of Professional Engineers in his second year. He was also awarded the Gold Medal at graduation. Extra-curricular activities included fencing, debating and contributions to the *Slide Rule* and *Year Book.*

ENGINEERS' WIVES ORGANIZE

Recently in Ottawa there was completed another engineers' wives association. This has been modeled somewhat along the lines of an organization of the same title in Winnipeg, which organization has been functioning successfully for many years.

Mrs. K. M. Cameron was elected president of the Association, and the following additional officers were selected at the same time: Vice-president, Mrs. L. N. Christmas; secretary, Mrs. D. H. Hand; treasurer, Mrs. R. L. Franklin, society chairman, Mrs. H. E. Treble; membership chairman, Mrs. J. Irvine; and councillors, Mrs. G. R. Turner and Mrs. Robert Blais.

The Association has drawn up and approved a constitution and rules of procedure.

Membership in the Association is open to the wives and widows of professional engineers, without regard to whether or not their men folks belong to any of the established engineering organizations.

The purpose of the Association is to afford the wives opportunities for renewing old friendships and for making new ones, particularly in the case of families moving into Ottawa; and also, for assisting various undertakings that have a professional, municipal or national significance.

At the inauguration meeting there were 46 ladies in attendance, and since that time 23 additional persons have joined the Association. In this way there is a strong group already behind the new undertaking which guarantees its success.

In order to properly publicize the plan to form such an association a preliminary dinner dance was sponsored last April. This brought together a large group and afforded the promoters the necessary opportunity for explaining the objectives and advantages of such an organization.

This completion of the organization for the second engineers' wives association in Canada will offer encouragement to groups at other centres who have been considering the same idea. The pattern was set by the ladies in Winnipeg, and any persons who are interested can secure complete information from that city. The Headquarters of the Institute has copies of the constitution of both organizations and will be glad to supply them to any groups that may be interested.

HOOVER MEDAL AWARDED TO DR. VANNEVAR BUSH

The Board of Award for the Hoover Medal has announced that the 1946 recipient has been chosen. The medal was presented at the Winter meeting of the American Institute of Electrical Engineers to Dr. Vannevar Bush, President of the Carnegie Institution of Washington, and Chairman of the recently created U.S. Joint Research and Development Board of the War and Navy Departments.

The Hoover Medal, founded in 1929, was instituted to commemorate the civic and humanitarian achievements of Herbert Hoover and the first award was made to him in 1930. The fund is held by the A.S.M.E. and is administered by a board representing the four founder societies of the United States. The medal is awarded " to a fellow engineer for distinguished public service " and the citation for the 1946 award reads in part, " Vannevar Bush, engineer, educator, and administrator who, in critical time of need, was in a most special sense, an organizer, guiding spirit and driving force of the nation's achievements in physical and medical science".

Vannevar Bush is perhaps best known for his development of the differential analyzer and his proposal, organization and chairmanship of the U.S. Office of Scientific Research and Development, which directed and coordinated all U.S. Scientific efforts during the second world war.

THE ARCHITECTS WIN AGAIN

Recently the Court of King's Bench of the Province of Quebec handed down a decision in the appeal of Brian R. Perry, M.E.I.C., against the judgment of the Superior Court which had ruled at the request of the Architects Association of Quebec that he had contravened the architects' act when he designed and supervised the construction of an industrial building. The appeal judges upheld the decision of the lower court.

There is a lot to be said on the case, and the *Journal* will treat it at length in the next issue, but for the moment attention is called to an editorial appearing in the *Engineering News Record* of May the 15th as follows:

A Jurisdictional Dispute

Across the Border in Quebec, architects have dragged a civil engineer into court in a jurisdictional dispute that should cause all reputable architects in the province to blush with shame as the court action was inaugurated and carried up to the provincial court of appeals by the Architects Association of the Province of Quebec. The civil engineer concerned had designed and supervised construction of an extension to the plant of the Harrington Tool and Die Co. at Lachine, Que. No question of his competence to design a safe structure was involved; the court action was obviously an effort to use the wording of the architects' registration act as a means for curtailing the building design work done by registered civil engineers, thus cutting down their competition with architects in that field. About 15 years ago, a small group of architects in New York State started a similar action with the same objective, but when it was brought to the attention of the top men in the American Institute of Architects they stopped the movement. It is too late now for similar action in Quebec, but the leading architects of that province can nullify the effort of the appeals court decision by seeing to it that the decision is never used to keep engineers from designing buildings.

MEETING OF COUNCIL

Minutes of the annual meeting of the Council of the Institute held at the Royal York Hotel, Toronto, Ontario, on Wednesday, May 7th, 1947, convening at ten o'clock A.M.

Present: President J. B. Hayes (Halifax) in the chair; Past-President deGaspe Beaubien (Montreal); Vice-Presidents J. E. Armstrong (Montreal), W. R. Manock (Fort Erie), and C. E. Sisson (Toronto); Councillors G. M. Brown (Saint John, representing the Association of Professional Engineers of New Brunswick), C. S. Clendening (Lethbridge), G. J. Currie (Halifax), J. R. Dunbar (Hamilton), R. S. Eadie (Montreal), R. C. Flitton (Montreal), A. E. Flynn (Halifax), S. W. Gray (Halifax, representing the Association of Professional Engineers of Nova Scotia), A. R. Jones (Peterborough), W. H. M. Laughlin (Toronto), C. C. Lindsay (Montreal), J. G. MacGregor (Calgary), G. L. Macpherson (Sarnia), Norman Marr (Ottawa), J. M. Patton (Regina), C. A. Peachey (Montreal), P. M. Sauder (Strathmore, representing the Association of Professional Engineers of Alberta), Carl Stenbol (Sault Ste. Marie), D. M. Stephens (Winnipeg), J. B. Stirling (Montreal), J. A. Vance (Woodstock), Paul Vincent (Quebec), and W. S. Wilson (Toronto); Treasurer J. A. Lalonde (Montreal); General Secretary L. Austin Wright, retiring Assistant General Secretary Louis Trudel, and the newly appointed Assistant General Secretary W. D. Laird.

There were also present by invitation: Past-Presidents E. A. Cleveland (Vancouver), T. H. Hogg (Toronto), C. J. Mackenzie (Ottawa), F. P. Shearwood (Montreal) and C. R. Young (Toronto); Past-Vice-President E. V. Buchanan (London); Past-Councillor H. E. Brandon (Toronto); President-Elect L. F. Grant (Kingston); Councillors-Elect J. A. Beauchemin (Montreal), F. R. Burfield (Edmonton), K. G. Cameron (Montreal), J. R. Carter (Kingston), C. E. Gelinas (Montreal), Viggo Jepson (Grand'-Mere), J. H. Irvine (Ottawa), A. H. MacQuarrie (Walkerville), and L. E. Mitchell (Halifax); Branch Chairmen: P. A. Dupuis (Quebec), A. D. Harris (Border Cities), C. E. Marlatt (Kootenay), E. C. O'Leary (Halifax), F. R. Pope (Peterborough), and E. G. Wyckoff (Hamilton); Roger Desjardins, secretary, Quebec Branch; Committee Chairmen: G. A. Gaherty, Prairie Water Problems, Wills Maclachlan, Industrial Relations, G. N. Martin, Employment Conditions, H. R. Sills, Membership, and H. M. Scott, representing R. L. Dobbin, Community Planning; J. Murray Muir, secretary, Association of Professional Engineers of Ontario; Toronto Branch: R. F. Legget, chairman, E. A. Cross, immediate past chairman, J. G. Hall and D. D. Whitson, members of the executive.

In welcoming the councillors and guests, President Hayes invited all persons present to take part in the various discussions. He felt that this was an inspiring group, representatives being present from twenty-two out of twenty-eight of the Institute branches, which in his opinion constituted a record attendance.

Death of Lorne A. Campbell: Council noted with sincere regret the death of Lorne A. Campbell, of Trail, British Columbia, which had occurred on April 29th, 1947. Mr. Campbell had been awarded the

Sir John Kennedy Medal for 1946. The following resolution was passed unanimously:

"The Council of The Engineering Institute of Canada, at this annual meeting, wishes to record its deep sorrow at the passing of Lorne A. Campbell—a beloved and respected member of this organization for many years. Councillors have an appreciation of the great work he has accomplished for Canada—of the example of perseverance which he has set for the profession. Few men have been able to build such outstanding monuments to themselves as those left behind by Mr. Campbell in the Kootenay area—monuments which will continue for generations, to benefit mankind.

To the members of Mr. Campbell's family, Council sends its sympathy."

Committee on Professional Interests—Mr. Stirling, chairman of the committee, reported on the following items.

(a) *Letter from Vancouver Member:* This letter (from W. O. Scott) had been directed by Council to the committee for a recommendation as to action. Mr. Stirling reported that the letter had been carefully considered and the committee regrets that Mr. Scott cannot concur with Council's decision concerning Institute policy. Mr. Stirling pointed out that Mr. Scott stated his views were personal and his letter did not ask for a reply. However, Mr. Stirling stated that, as this was the only one received from an individual member that has not approved of Institute policy, he thought a reply was warranted. He submitted a draft letter which was approved.

(b) *Resolution from Winnipeg Branch:* This resolution had been studied by the committee and was found to be far from clear. It seemed to be possible of different interpretations and, accordingly, the committee had written back to the branch asking for some clarification. Upon receipt of a reply the resolution will be studied and a reply prepared.

(c) *Budget Item 180e:* At Mr. Stirling's request the general secretary reported on the situation as it stood now.

(d) *Letter from the Saguenay Branch:* This communication had been received at Headquarters on March 17th just too late to be referred to Council at the meeting in Saint John on March 15th. The letter dealt with the Institute's relationship with the new Canadian Council. As the branch was holding a meeting on March 20th and wanted a reply by that time Mr. Stirling had written to the secretary of the branch immediately, and a letter was also sent by the general secretary suggesting that the matter might be discussed in detail before the whole branch on the occasion of the president's visit there, at which time it was expected that one or more members of the committee would be in attendance.

Mr. Stirling reported that, up to the present time, no acknowledgments of the letters or telegrams had been received and therefore the committee felt somewhat at a loss to know how to proceed. He reported that as soon as some word is received from the branch the matter will be given further attention.

Mr. Cross asked if Council could be informed of the contents of the letter to which Mr. Stirling had referred. Mr. Stephens asked what further information the committee would like to have with regard to the Winnipeg resolution.

Mr. Stirling replied that as far as Winnipeg was concerned all they were trying to get was some clarification as to what certain clauses of the resolution meant. He then read the letter from the Saguenay Branch, in response to which the president suggested that the chairman of the committee continue to contact the branch so that the matter could be concluded to everyone's satisfaction.

Mr. Sauder reported that some of the junior members of the Association of Professional Engineers of Alberta were confused by the fact that one of the organizations to which they belonged supported the new Council, whereas The Engineering Institute did not.

The president suggested that this was a good time to discuss the matter in detail so that the councillors could be fully informed when they returned to their branches. In his opinion one criticism of the new Council was that it was made up of a miscellaneous group, several members of which were not in the engineering field. He commented that the matter had been seriously considered by the committee and by Council many times and that on every occasion Council had come back to the same conclusion. However, if the councillors thought that the younger members did not understand the situation or were concerned by the action of their Council, he believed the matter should be given further consideration openly before this meeting.

Mr. Dunbar stated that he was thoroughly behind the stand taken by Council and that he was of the opinion that the younger engineers did not know all the facts and therefore misunderstood what had occurred.

Mr. Stephens reported that the Winnipeg Branch would support Mr. Dunbar's views and would oppose the Institute joining the Canadian Council as it is presently constituted. However, some members of the Winnipeg Branch had thought that the Institute had failed to give the leadership that had been hoped for in providing a forum through which sister societies or related scientific bodies could be co-ordinated. He stated that the Winnipeg Branch had had some difficulty in framing the memorandum referred to. In essence, the branch had wished to express the hope that something might be devised to establish a more systematic method for co-operation rather than just getting together as an occasion arises. He hoped the Institute would be prepared to take steps towards bringing this to pass. The Winnipeg resolution was not an endorsement of the Canadian Council.

Mr. Martlatt reported that, in the Trail area, there were several societies which had set up a joint committee in order to prevent overlapping and to expand the usefulness of each organization. It had worked out to be mutually advantageous.

Mr. Burfield reported that the Edmonton Branch had asked him to discuss this matter so that they might have some explanation as to why the Alberta Association supported the Council and the Institute did not. Mr. Patton reported that a somewhat similar situation existed in Saskatchewan. He appreciated that the Institute's principal objection to the new organization was that it (the Institute) did not wish to delegate executive powers to an overall organization.

Mr. Stirling stated that the discussion was very interesting and that already he had obtained answers to some of the questions which had been referred back to the Winnipeg Branch. The contributions of other speakers had also been helpful. He agreed with Mr. Patton's comment that the Institute did not wish to delegate executive powers to another organization. He thought the Institute, in view of its size and its actives, was too large and important to hand over some its power to another group. He quite agreed that ere should be consultation and co-operation between all groups and pointed out that in the statement of Council this point had been covered clearly. e did think, however, that it was more difficult to velop basic co-operation in a miscellaneous group an in a group with an identity of interests. He ought engineering groups had a great deal in common and could co-operate quite readily but was raid that the specialized interests of non-engineerg societies, including agronomists and dietitians oth being members of the Canadian Council) would nit co-operation to subjects of lesser importance.

Mr. Vincent suggested that Council publish a memandum reviewing the whole subject so that the embers would have a better understanding of the asons why the Institute did not support the Canaan Council.

The general secretary stated that, as the Institute embership had been circularized by other individuals and/or organizations with material which did ot present the story as the Institute saw it, the ommittee on Professional Interests had felt it derable to also circularize the membership, stating the ise as it was seen by the committee and by Council. ouncil had approved this proposal and, in January 947, a detailed memorandum had been sent by direct ail to every member. In addition to this, Mr. tirling had spoken to several branch executives, and, om time to time there had been other comments *The Engineering Journal*. He was of the opinion hat the complete material had already been placed efore the membership.

Mr. Lindsay was of the opinion that many people isunderstood the new Council, believing that all rganizations in Canada other than the Institute were upporting it. He stated that this was not so. Recently he Canadian Institute of Surveyors had withdrawn rom it. There was one organization of foresters in he membership but it did not represent the main group as did the provincial organizations. He thought t was quite unreasonable to ask the Institute to pay portion of the financing, based on its large memberhip and yet to have only one single vote on any ssue. He pointed out, too, that on the Canadian Council, a two-thirds majority could carry any issue egardless of the small number of individuals that night be represented by the majority vote.

Mr. Lindsay pointed out, further, that the cost of he new Council might become very great. In fact, at one time a budget of over $30,000.00 had been proposed. He thought the additional expense was not ustified. He was of the opinion, also, that the activities of other organizations such as the Engineering Institute and the provincial professional associations ncluded largely the same subjects as the Canadian Council proposed to deal with. In his opinion, the field s already well covered.

Mr. Armstrong stated that there were four minor points that he would like to make.

(1) The correspondence which has come to Headquarters and to the committee indicated that the "engineer in the street" does not always distinguish between the Dominion Council and the Canadian Council. He referred to a letter received by the Institute protesting its failure to support the Dominion Council. The author had the two organizations mixed.
(2) The Dominion Council has announced through its president that it speaks with the voice of all Canadian engineers, and the Canadian Council has also made the statement, in writing, that it speaks with the voice of all Canadian engineers. He pointed out that the Institute had never made such a claim. He thought the two statements showed the overlapping of the policies of those two organizations.
(3) He pointed out also that in the statement of policy of Council it had proposed a committee of collaboration between appropriate bodies with no organizational cost and a minimum of secretarial cost, and that the chairmanship and the secretariat be rotated among the participating bodies in order to give a balance in control.
(4) It was his opinion that this subject had been given considerable space in *The Engineering Journal* and he suggested that the pages might be reprinted and issued as a special issue or as a supplement to *The Engineering Journal.*

Referring to the subject of operating the Canadian Council, he pointed out that, at one stage, it had been recommended by one member organization that the supporting societies be assessed $2.00 per member. This would mean that the Institute would have to pay between $15,000.00 and $25,000.00 a year which, of course, was ridiculous — all for the purpose of having one vote in a miscellaneous group of ten or twelve societies.

Mr. Peachey directed a question to the Winnipeg councillor, asking him if the branch executive had carefully read the material in the *Journal* item by item, at the time they prepared their resolution. As a councillor, he had read the various articles and had come to the conclusion that the Institute was right in not joining the new Council.

In reply, Mr. Stephens stated that the committee had studied all the material they could find and he emphasized that the Winnipeg executive, in its resolution, had not proposed that the Institute should join the Canadian Council but had been concerned principally with the fact that there were several problems in common which might well be discussed in a common forum.

Mr. Jones was of the opinion that, from the evidence at this meeting, it was apparent that articles in *The Engineering Journal* had been misinterpreted or misunderstood. He inquired as to whether or not it would be an imposition to ask Mr. Stirling's committee to prepare a summary of the situation which would be presented to Council for the information of the branches. He thought such a restatement would do away with any suggestion that this matter had developed into a controversy.

Mr. Eadie reminded Mr. Stephens that Council had already declared itself as prepared to support a co-operative committee which acted in a consultative capacity only. This fact was communicated to the chairman of the Canadian Council and to the constituent members but there had been no response from them.

Mr. Beaubien pointed out that as one familiar with this subject from its beginning, he thought it should be noted that the Institute, by its refusal to join, had not intended any disparagement of the new Council. He referred to the memorandum which was sent to all members in January which he thought stated the case very clearly and concisely, and he emphasized that the Institute itself was ready to join a co-operative body of the type described.

Mr. Sills thought that in issuing anything to the membership the following points should be covered.

(1) That the present secretariat (of the Canadian Council) is much quicker on its feet in finding out what legislation is being prepared than is the Institute secretariat.
(2) That the Ministers listen more favourably to representations of one body speaking for many than to representations of several individual organizations.
(3) That although the Institute would have only one vote on the new Council the mere fact that it can resign at any time means that it would not have to give away its authority to another organization.

Mr. Stirling replied to Mr. Sills' three points as follows:

(1) The only evidence available indicated that the secretariat of the Institute had been much quicker on its feet than had that of the Canadian Council. He referred to Item 180e in the customs tariff, pointing out that the Minister of Finance had stated in the House, according to Hansard, that up to the time he was questioned by a member of parliament he had had only one complaint about this tariff change and that had been from the general secretary of The Engineering Institute of Canada. It was five months later than the date of the original protest from the general secretary that the Canadian Council brought its protest to the authorities at Ottawa.
(2) He was of the opinion that the Ministers are more impressed by separate representations from several organizations than from one. He pointed out that in the last six or seven years he had had a great deal to do with matters of this kind and he was confident that the group voice in this instance would not carry the weight that the separate voices would carry.
(3) He admitted it was true that the Institute could always withdraw from the Canadian Council if it were outvoted on an issue which it could not support. However, he thought this was poor policy and referred to what had happened in the Committee of Fourteen at the time the proposal was made to establish the Canadian Council. Although the Institute at that time had asked that no action be taken at that particular meeting, in view of the fact that in the Institute's opinion there was insufficient representation, the vote was taken and the Institute was outvoted.

   He also referred to the development in the Dominion Council, pointing out that originally it was a non-executive body, restricted in its interests to the matter of registration. Bit by bit its by-laws have been amended until today it proposed to participate in many activities already covered by the Institute, and even stated through its president that it was now " recognized as the voice and mind of the professional engineers in Canada."

Mr. Flynn stated that he had been following discussions of this kind for many years. He had heard the same arguments over and over. He thought some persons were frightened of the possibilities of an organization such as the Canadian Council. However, he had attended recently a meeting of the organization and he had not seen any reasons to be frightened. He reported that no action was taken on any issue unless it was agreed to unanimously. He said he would like to see the Institute take some positive action although he did not care to suggest what it might be. He would like to see some means established " to get us all acting together ".

Mr. Sauder reported that he had heard discussions on this subject at meetings of the Association in Alberta but that he did not feel that he was sufficiently well informed to meet some of the criticisms that had been offered. However, he thought this discussion was very valuable and because of it he was now in a position to answer the criticisms, including those which came to him in the mail in the form of letters or speeches circulated by other organizations.

Mr. Lalonde stated that he had attended many meetings of Council where this matter had been discussed. Frequently he had moved or seconded motions not to join the Canadian Council. He felt that the reasons had been adequately stated in the statement of policy issued by Council and through the circular distributed in January and mentioned by Mr. Beaubien. He favoured co-operation with other organizations " to the limit ", as long as the interests of other societies were not jeopardized. He pointed out that it was not easy to get complete co-operation. As an example, he referred to the application made by the Corporation of Professional Engineers of Quebec for an amendment to its Act. When the Bill was before the committee in Quebec, several organizations represented on the Canadian Council had officers and legal counsel there to argue against the amendment being allowed. This was not a very good example of the results of setting up a co-operative organization.

He referred to one of the publications mentioned by Mr. Sauder which had been circulated presumably by the Canadian Council. He could not agree with the document and thought the author was making proposals which he (Mr. Lalonde) as an engineer and a member of the Corporation of Professional Engineers of Quebec could not support. In conclusion, he asked the question, " What good are we going to get out of a super-organization like the Canadian Council? " He stated that the matter had been discussed many times in the Council of the Corporation and the Council of the Institute. He thought the Institute should be certain of its own policy and be prepared to stand on its own feet to make its organization as big and as good as it can be, not only for the older members but for the younger members as well, rather than spend " all our time discussing this matter " of another council.

Colonel Grant stated that he agreed entirely with the action taken by Council but he was somewhat disturbed by the possibility that criticisms and questions were arising with the young engineers who, in a few years, would be the bulk of the membership of the Institute. In that connection he asked councillors at this meeting to bring up this question when he is visiting the branches so that the younger men could be given a full opportunity to express their views and to know that the senior officers of the Institute are interested in considering all questions that affect them.

The president pointed out that there was no action that Council should take at this meeting but he was glad that the subject had been discussed at such length as it had thrown a great deal of light on the subject. Personally, he was certain that the policy of the Institute was sound and correct. Perhaps a good job of selling Council's decision had not been done in the membership although several steps had been taken to that end.

Students' Conference: Mr. Wright reported second conference of representatives from the various engineering societies would be held in the hotel on Saturday morning, May 10th. It was expected that every university would be represented although the Nova Scotia Technical College is unable to send a representative from Halifax, as their examinations are being held this week. They hope, however, to have a recent graduate represent them. The conference is being held under the auspices of the Institute's Committee on the Training and Welfare of the Young Engineer. The first conference held in Montreal last year at the time of the annual meeting had been most successful and the students were enthusiastically in favour of holding another such conference this year. It had been suggested that it would contribute greatly to the success of the conference if members of Council and officers of the Institute present at this meeting would take a special interest in these young men. This report was noted.

Changes and Additions to Headquarters Staff: The president reminded the meeting that the Institute was losing the services of Louis Trudel who, for eight years, had been with the Institute in the capacity of assistant general secretary. He wanted to take advantage of this opportunity to pay a tribute to Mr. Trudel for the work that he had done. He stated that by reason of his travelling and through meetings he had gained a very close picture of Mr. Trudel's personality and ability. He thought that his contribution to the Institute had been very great and was certain that he would be seriously missed.

In acknowledgment, Mr. Trudel thanked the president for his kind words and also expressed his gratitude to the officers of the Institute and to the past-presidents. He believed the experience gained in the Institute would be of great help to him in other places. He thought the Institute was a great school of Canadianism. He wished his successor every success and at the same time assured him of his availability if his assistance was required.

The general secretary reported on the results of the canvass for someone to replace Mr. Trudel. He stated that there had been applications from many well qualified persons and that in the last analysis it was not easy to make a decision. However, the final decision had been made and he presented to the meeting Mr. William Douglas Laird, a graduate of the University of Manitoba, who had accepted the appointment.

Mr. Wright went on to report that no decision had been made with regard to a field secretary or a technical editor inasmuch as these vacancies had been held in abeyance until the assistant secretaryship had been filled.

Mr. Laird thanked the meeting for its kind reception and stated that he had seen enough of the operations of the Institute to realize how difficult it would be for him to replace Mr. Trudel. He could only promise that he would do his best to fill the position to the satisfaction of the officers of the Institute.

The meeting adjourned for lunch at twelve thirty P.M., and reconvened at two o'clock P.M., with Vice-President C. E. Sisson in the chair.

Pension Plan for Headquarters Staff: The desirability of establishing a pension scheme of some kind for the Headquarters staff was discussed, and on the motion of Mr. Sauder, seconded by Mr. Patton, it was unanimously resolved that the Finance Committee be asked to study the question and bring in a comprehensive report to an early meeting of Council.

Brian Perry Case: The general secretary reported that the appeal against the decision that Mr. Perry was at fault in designing a specific building in the Montreal area had been lost. The five judges of the Court of King's Bench had returned a unanimous verdict supporting the findings of the trial judge.

He reported further that the Corporation of Professional Engineers of Quebec and the Association of Architects of the Province had a joint committee discussing proposals to amend the Engineers' Act and it was hoped that eventually some amendments to the Act could be secured that would clarify the present confusion with regard to the fields of the two professions.

Mr. Stirling pointed out the seriousness of this adverse ruling and he thought councillors should all familiarize themselves with what had occurred so that they could inform their branches.

Mr. Laughlin stated that as a councillor of the Association of Professional Engineers of Ontario and as a consulting engineer he was much interested in the King's Bench decision. He inquired as to whether or not there was any further appeal. If there were, he hoped that the Institute would take advantage of every opportunity to take the case to a higher court.

The general secretary stated that the notes of the five judges were now being examined by legal counsel to find grounds upon which a further appeal could be entered.

Mr. Laughlin pointed out further that this decision would have significance in other provinces and he hoped Headquarters would make the full information in the case available to those provinces that desired to study it.

Committee on Community Planning: Mr. H. M. Scott, a member of the Institute's Committee on Community Planning, had been asked by the chairman, Mr. R. L. Dobbin, to present a report on the work in the community planning field with which the committee thought the Institute should concern itself. The report may be described briefly as follows.

In the preamble the statement is made that "Community planning has been a failure to date in that it has not demonstrated its effectiveness to correct the social sores of modern civilization."

As far as the Institute is concerned the committee believes that "to obtain full benefit for our country in general and to the individual communities, the Institute as a whole must be the responsible leader in community planning so that the whole weight of the engineering profession may be thrown into the balance rather than the windmill tilting of an individual engineer or engineering firm".

The report concludes with a list of fundamentals which it recommends must be recognized and treated if community planning is to fulfil its purpose.

The general secretary augmented the report by stating that this proposal was devised as a lead up to the community planning conference which was planned for November in Toronto.

Mr. Peachey thought the report an excellent one but pointed out that the question of costs would be a serious one. Mr. Scott replied that the costs of not doing these things might even be greater. He thought the costs to do these things properly would be much less than the costs as they are accruing today for having them done incorrectly.

Mr. Armstrong asked if his summarizing of the report was correct, namely, that it was proposed to develop certain essential basic information which would be put together in one manual. In his opinion this was perfectly sound project — one that should not be difficult to "sell".

Mr. Patton said he would like to give support to the recommendations of the committee. He referred to planning that was being done in the city of Regina and he thought the Institute should definitely support town planning in any community.

Past-President Mackenzie stated that it was a long time since he had been specially interested in community planning but he still thought it was a very commendable thing. He did not believe that the matter of costs was the controlling factor but he did think it was essential to have the proper support given to the movement if anything were to be accomplished. He stated that at the Research Council they were starting a research project on housing and building materials in which the Institute might become interested. He thought the subject of community planning was an active one and would grow in interest and he thought the Institute should definitely take a leading part in it.

Mr. Sisson, Mr. Armstrong and Mr. Eadie were of the opinion that the conference should afford the engineers the maximum opportunity to develop their thinking and their support for community planning. It was recognized that other professions and other groups of people were interested in the subject but it was their idea that to introduce other groups into this conference would be to lessen the benefits that might accrue to the engineers.

At this point President Hayes returned to the chair.

Toronto Memorandum: Mr. Laughlin explained that at the request of the Toronto Branch he had asked the general secretary to place on the agenda the memorandum which had been sent to Headquarters by the Toronto Branch in December 1945. (Secretary's note: This brief was presented to the annual meeting of Council in Montreal in February 1946 and was referred to the Committee on Professional Interests. That committee had prepared a reply which was presented at a regional meeting of Council held in Toronto in April 1946. At this meeting the reply was accepted without a dissenting vote—see minutes 4452-55).

Professor Legget explained that the Toronto Branch had thought it desirable that the memorandum be reconsidered at this annual meeting of Council. He did not consider that it was necessary to go into all details but he wanted to point out that the memorandum covered three main points—(1) A recommendation that the fees of the Institute should be increased; (2) references to a matter of policy; and (3) the reconstitution of the Council.

He noted that Item 1 had adready been attended to and he stated that for Item 2 it was not proposed to go into that at this time, but he did want to emphasize Item 3.

The Toronto memorandum recommended a reduction in the number of members of Council and that Council should meet four times a year with an executive committee functioning between meetings. It was recommended that the expenses of councillors coming to Council meetings be paid. In this way it was believed there would be a fuller attendance of councillors and a more efficient handling of Institute business. He thought this method would be much more democratic than that which is now being followed.

The president pointed out that it was the practice of the Institute to hold Council meetings from one end of the country to the other. He proposed that any suggestions of a reorganization of Council should more properly be considered by the incoming president and the incoming Council.

Mr. Dunbar pointed out that many of the problems referred to in the brief were particular to the city of Toronto but that some were also applicable to other parts of Ontario. Therefore he moved that the memorandum be referred to the Ontario Provincial Division for discussion and report. This was seconded by Mr. Laughlin.

The general secretary reported that recently he had reread the minutes of the branch round table conference held in Montreal in 1937, at which Professor Legget was present. These minutes indicated that the identical subject had been discussed very widely at that time but had not been approved by the conference.

Mr. Eadie stated that as he recalled it, the Toronto memorandum and the committee's reply had already been circulated to all branches (in 1946).

Mr. Sauder stated he was a member of the committee which had discussed this same subject ten years ago. He referred to an endeavour which had been made in Alberta to set up a provincial division which had not been successful. He stated that as far as the western branches were concerned they preferred the present system which was found satisfactory.

At this point the president put Mr. Dunbar's motion to the meeting and it was carried unanimously.

Conference on Industrial Management: The general secretary reported that certain members had proposed that the Institute hold a conference on industrial management some time after the conclusion of the International Management Conference which is being held in July in Stockholm. He was presenting the matter to Council on behalf of these members with a request that authorization be given for such a conference.

Mr. Peachey stated that he was one of the members who had raised the question. He pointed out the rapid growth of Canadian industry and the consequent increase in importance of management. He thought the Institute should do everything it could to develop management ideas in the young engineers. In response to the president's inquiry as to a plan, he replied that he thought a conference something along the lines of that planned by the Committee on Community Planning would be excellent. It might be held in Montreal, Toronto, or some intermediate place. He concluded by making a motion that in order to show a definite interest and to give leadership in the problem of administration, the Institute approve of a one or two day conference on management some time in the fall of 1947 or the winter of 1948. This was seconded by Mr. Harris and carried unanimously.

Student Guidance: The general secretary presented a letter from W. R. McClelland, secretary of the Canadian Committee for Student Guidance in Science and Engineering (This committee is made up of representatives of the Canadian Institute of Chemistry, the Canadian Institute of Mining and Metallurgy and The Engineering Institute).

This letter asked the Institute for an expression of opinion with regard to a proposal to issue a new booklet covering all branches of engineering and professional science. The letter states that at present different booklets are being used to cover different parts of the field and suggests that a single joint booklet might do a better job.

The letter points out that the Interdepartmental Committee on Professionally Trained Persons (composed of certain departmental heads, which functions as an advisory body to the Minister of Labour) is alive to the need of such a publication " as a proper function of government".

Colonel Grant outlined the work of the Institute's Committee on the Training and Welfare of the Young Engineer, mentioning that the Institute's booklet " The Profession of Engineering in Canada " has been revised recently to include sections on radio and aeronautics. This booklet has been used by the joint committee on student guidance and Colonel Grant was of the impression that in its new form it met the situation reasonably well.

He emphasized the difficulties of getting a new booklet that would be satisfactory to all concerned but thought that the Institute should go along with the other two institutes in investigating further the possibilities of such a project. This recommendation was approved unanimously.

Border Cities Branch By-Laws: On the motion of Mr. Dunbar, seconded by Mr. Eadie, it was unanimously resolved that the proposed amendments to the by-laws of the Border Cities Branch, as submitted, be approved.

Membership Committee: The general secretary reported that Mr. Huet Massue, M.E.I.C., of Montreal, had prepared a very comprehensive and interesting report on the development of membership within the Institute. The report was accompanied by many graphs. A copy of the report had been sent to the chairman of the Membership Committee, Mr. Sills, who had expressed approval of it and had stated that it would be very useful to the committee.

Mr. Sills stated that the report was " really a masterpiece ". He thought the information could be used to advantage by most of the standing committees and some of the special committees. He suggested that additional copies be made available for such purposes.

The president approved of the suggestion that the report be put in the hands of other committees as well as the one on membership. Finally, on the motion of Mr. Flynn, seconded by Mr. Flitton, it was resolved unanimously that the graphs be displayed during the annual meeting and that Mr. Massue be thanked on behalf of Council for this excellent piece of work.

Proposal for a Branch in Newfoundland: The general secretary reported that from time to time members in Newfoundland had inquired as to the possibility of a branch being established there. Recently two members had written in about it and within the last ten days a member had called at the office to discuss the matter in greater detail.

This member pointed out that as there was no professional engineers' act in the country, membership in the Institute would have an added significance. He also suggested that through activities of an organized group something might be done to enhance the prestige of the profession which, up to now, had not been impressive in that country.

The secretary reported that there were now about thirty-five members of all classes. The member visiting the office had brought with him a further list containing thirty-five engineers who were not members but who would be interested in joining if a branch were established. This member had suggested that if a senior officer of the Institute could visit the country and perhaps speak at the main centres, he would have rendered a real service to the profession and doubtless the trip would result in the formation of a branch.

Mr. Stirling stated that during the years 1940 to 1945 he had spent about one-third of his time in that country and therefore was thoroughly familiar with conditions. Therefore he moved that steps be taken forthwith to investigate the possibility of establishing a branch there. This was seconded by Mr. Eadie and carried unanimously.

Parliamentary and Scientific Committee in Canada: The general secretary reported that recently a meeting of several organizations had been held in Ottawa to consider the formation of a Parliamentary and Scientific Committee along the lines of such an organization established some time ago in Great Britain. The meeting had been held on April 25th and Past-President Cameron had attended as the Institute's representative.

The president suggested that in view of the lateness of the hour and the amount of material that had to be considered, the whole matter be referred without further discussion to the Committee on Professional Interests. This was agreed to.

Expenses of Councillors: Mr. Marlatt proposed that Council should give consideration to meeting the expenses of councillors in attendance at meetings. He emphasized the difficulty of a councillor from a branch as far away as the Kootenay being able to finance expenses to a meeting at a central point such as Toronto. Mr. Gray stated that councillors in the east were also interested in such a proposal, and Mr. Patton said that he would like to give support to Mr. Marlatt's suggestion.

Mr. Armstrong thought this matter was the one mentioned in the Toronto memorandum which was to be considered by the Ontario Division, and Mr. Peachey pointed out that Council had already expressed a favourable opinion on such a proposal.

It was pointed out that one of the reasons for recommending the recent increase in fees had been that it was hoped to meet some part of the expenses of councillors attending meetings. In view of the fact that it was already before the Finance Committee no further action was taken.

Banff Meeting—1948: The general secretary reminded Council that it had been agreed that a meeting would be held in the Banff Springs Hotel, Banff, Alberta, in June 1948, although it had not yet been decided as to whether this would be an annual meeting or a summer professional meeting. This was a point which should be settled by the incoming Council but it had been proposed that the subject be discussed before this meeting so that an expression of opinion could be transmitted to the new Council.

Messrs. Burfield and MacGregor stated that their branches were hoping that it would be an annual meeting. The president called for a showing of hands which indicated that all but a very small minority voted to recommend to the incoming Council that the Banff meeting be made the annual meeting for 1948.

Thanks to the Retiring President: Mr. Beaubien asked permission to express on behalf of all the members of Council, congratulations and thanks to the president for the masterly way in which he had conducted this and other meetings. He wished to say on behalf of all, " Thank you. You have done a splendid job."

In reply the president stated that he had hoped the meeting would conclude early enough that he could go around the table and personally thank everyone for his co-operation but as it was now too late he would like to say how stimulating the Council meetings had been to him.

The Council rose at five o'clock P.M.

L. Austin Wright, General Secretary.

ELECTIONS AND TRANSFERS

A number of applications were presented for consideration, and on the recommendation of the Admissions Committee, the following elections and transfers were effected.

Members

Brant, Arthur A., M.A., Toronto; Ph.D., Berlin Univ. (Germany); assoc. prof. physics, geophysics, Univ. of Toronto; private consultant, Toronto, Ont.

Darling, Douglas George, B.A.Sc., (Mech.); M.A.Sc., Toronto; production engr., Toronto Brick Co., Ltd., Toronto, Ont.

Golubowski, Wiaczeslaw, Mech. Engr., Tech. Institute of Danzig, tool design checker, Canadair Limited, Montreal,Que.

Holbrook, George William, Major, R.C.S., B.Sc., (Engrg.), Univ. of London, Canadian School of Signals, Kingston, Ont.

Kuhns, Allan Charles, B.Sc., (Civil), Queen's, asst. planning engr., National Capital Planning Commission, Ottawa, Ont.

L'Heureux, Joseph Francis Rene, B.A.Sc., C.E., Polytechnique, Supt. Chambly Canal, Chambly Basin, Que.

MacLean, James Herbert, Capt., R.C.E.M.E., B.A.Sc., (Mech.), Toronto, Directorate of Vehicle Development, M.G.O. Branch, Dept. National Defence, Ottawa, Ont.

McAdam, Wilfrid Josias, B.Sc., (Civil), Saskatchewan, asst. to chief engr., J. L. E. Price & Co. Ltd., Montreal, Que.

Mickleborough, Karl Franklin, B.A.Sc., Toronto, genl. asst. engr., canal services, Dept. of Transport, Ottawa, Ont.

Smith, John McClement, Graduate, R.M.C.; B.Sc., (Civil), Queen's, junior engr., (civil), H.E.P.C. of Ontario, Toronto, Ont.

Sznajder, Stanislaw Feliks, B.Sc., (Civil Engrg.), Warsaw University, structural designer, C. D. Howe Co., Ltd., Hamilton, Ont.

Williams, Egbert R., B.A.Sc., Toronto, works manager, Shawinigan Chemicals Limited, Shawinigan Falls, Que.

Juniors

Ball, Robert Spencer, B.A.Sc., (Mech.), Toronto, assignment engr., Canadian Cellucotton Products Co., Ltd:, Niagara Falls, Ont.

Brown, Gordon Leroy, B.A.Sc., (Civil), Toronto, field engr., L. R. Brown Co., Ltd., Sault Ste. Marie, Ont.

Denham, Harry Frederick, B.A.Sc., (Mech.), Toronto, asst. to elect. engr., Canadian Pacific Railway, Toronto, Ont.

Feldman, Saul, B.Sc., (Elect. Engrg.), Manitoba, demonstrator, dept. of elect. engrg., Univ. of Manitoba, Winnipeg, Man.

Shales, John Stanley Lennox, B.A.Sc., (Engrg. Physics), Toronto, sales engr., engine, pump and elect. dept., Canadian Fairbanks Morse Co., Ltd., Toronto, Ont.

Tracy, William Raland, B.Eng., (Mech.), Nova Scotia Tech. College, Sackville, N.B.

Affiliate

Scott, Arthur Benjamin, B.Arch., Toronto, consultant, arch. structural design, Welland, Ont.

Transferred from the class of Junior to that of Member

Clawson, William Kennerly, B.A.Sc., Toronto, engr. and road supt., County of Middlesex, London, Ont.

Connelly, Alan Burton, Brigadier, Graduate, Royal Military College; B.Eng., (Civil), McGill; Deputy Adjutant General, Army H.Q., Dept. of National Defence, Ottawa, Ont.

Craig, Clarence Edward, B.Sc., (Mech.), Queen's, supt., tubing and extrusion dept., Aluminum Co. of Canada, Kingston, Ont.

Davies, Richard Llewelyn, B.Sc., (Civil), Alberta, testing engr. for airports, Dept. of Transport, Wiarton, Ont.

Rodger, Norman Elliot, Major-General, Graduate, Royal Military College; B.Sc., Civil, McGill; Quarter Master General, National Defence Headquarters, Ottawa, Ont.

Weir, William Cecil, B.Sc., (Mech.), Saskatchewan, dist. constrn. supervisor, Veterans Land Act, Ottawa, Ont.

Wilde, William Clayton, B.Sc., (Elect.), Alberta, Edmonton branch mgr., Automatic Electric (Canada) Ltd., Edmonton, Alta.

Wishart, William Donald, B.Sc., (Elect.), Manitoba, General Staff Officer, Grade I, Directorate of Signals, Army H.Q., Ottawa, Ont.

Wright, H. Sinclair, B.Sc., (Mech.), Nova Scotia Tech. College, genl. supt., Demerara Electric Co., Ltd., Maracaibo, Venezuela, S.A.

Transferred from the class of Student to that of Junior

Martin, William Anderson, B.A.Sc., Toronto, metallurgist, Canadian General Electric, Toronto, Ont.

Admitted as Students

Students at Queen's University

G. M. Adamson	L. J. Leblanc	C. R. Newton
K. L. F. Coupland	J. A. McKillop	P. Schopflocher
J. Greenberg	D. E. Morrison	G. K. Wade

Students at Nova Scotia Technical College

A. K. Bernard	J. J. Fortier	L. D. McKenna
B. T. Daigle	H. D. MacLeod	N. B. Ward

Students at University of Toronto

F. A. Kottmeier	M. J. J. McAuliffe	N. D. Pappas

Students at University of New Brunswick

H. T. Floyd	R. G. Stuart	C. D. Stothart
	B. R. Machum	

Students at McGill University

V. J. Goodman R. B. Todd

Student at University of Alberta

G. V. Greenwood

By virtue of the cooperative agreements between the Institute and the associations of professional engineers, the following elections and transfers have become effective.

Alberta

Member

Bunston, Roy Frank Edward, B.Sc., Queen's, electrical engineer, Exshaw, Alta.

Junior to Member

McDiarmaid, Robert Batson, B.Sc., Alberta, manager, Insulation Industries Limited, Winnipeg, Man.

Saskatchewan

Junior

Pattison, Kenneth Reid, B.Sc., (Civil Engrg.), Saskatchewan, engrg. asst., City Engineer's Dept., City of Regina, Sask.

New Brunswick

Members

Peck, Gerald Allison, B.Sc., Acadia, Capt., R.C.E., camp engineer, Sussex, N.B.

Wetmore, Raymond Eugene, B.Sc., (Mech. Engrg.), Nova Scotia Tech., lubrication engr., eastern divn., McColl Frontenac Oil Co., Ltd., Moncton, N.B.

Woodroffe, Harvey A., Prov. Land Surveyer, N.S. Tech. Coll., engr. on constrn. and Mtce., R.C.A.F., Moncton, N.B.

Junior to Member

Baldwin, Oscar Lionel, B.Sc., (Civil Engrg.), New Brunswick, resident engr., highway constrn., Dept. of Public Works, New Brunswick, Boiestown, N.B.

Colpitts, Rolfe Reynolds, B.Eng., (Mech.), Nova Scotia Tech., design work, piping, structures, ventilation, International Paper Co., Dalhousie, N.B.

MacPherson, John Miles, B.Sc., (Civil Engrg.), New Brunswick, resident engr., highway reconstrn., Dept. Public Works, N.B., Fredericton, N.B.

Quebec

Members

Irwin, William Eric Crommelin, B.Sc., Elect. Engrg., McGill, processor, elect. section War Assets Corporation, Montreal, Que.

Sharpe, David Harold, executive chief engineer, Robert A. Rankin & Co., Montreal, Que.

Personals

News of the Personal Activities of members of the Institute

E. T. Buchanan, M.E.I.C., the newly elected chairman of the St. Maurice Valley Branch of the Institute was born at Montreal, Que. He attended McGill University, graduating in 1928 with a B.Sc. degree in electrical engineering. He spent four years with the Northern Electric Company as commercial engineer on toll telephone equipment, and from 1933 to 1935 he worked with L. R. Thomson of Montreal on economics of railways. In 1935 he joined the Consolidated Paper Corporation, Shawinigan Falls, Que., working first on mill costs and statistics and being appointed assistant master mechanic in 1937. He is still with the company at Grand'Mère, Que., as assistant chief engineer.

R. E. Kirkpatrick, Jr.E.I.C., has been appointed secretary-treasurer of the St. Maurice Valley Branch. Born in Montreal West, Que., he holds a bachelor of engineering degree from McGill University, Montreal. After graduation in 1937 he joined Dominion Engineering Co. Ltd., Lachine, Que. Two years later he entered the B. S. Coghlin Company, and in 1940 he went overseas with the R.C.A., and was seconded to the chief inspector of armaments in Woolwich Arsenal, England, with the rank of Captain. Recalled to Canada he was attached to the Inspection Board of the United Kingdom and Canada. He is now at Grand'mère, Que., as mechanical engineer for Consolidated Paper Corporation.

General the Honourable A. G. L. McNaughton, M.E.I.C., was decorated in April last as a Companion of Honour, at a ceremony at Government House, Ottawa.

Dr. Ernest Cormier, M.E.I.C., Montreal architect and engineer, has been appointed to the planning board of the United Nations Capital in New York. He is the only Canadian member of the consulting body.

A. L. Carruthers, M.E.I.C., has been named deputy works minister for the Department of Public Works of British Columbia. He had been chief engineer and chairman of the Highways Board for the Department. His service dates from 1917, when he was district engineer at Prince Rupert, B.C. He went to Victoria as bridge engineer in 1923, remaining in this position until his appointment in 1943 as chief engineer.

H. C. Anderson, M.E.I.C., has been appointed chief engineer of the Department of Public Works of British Columbia at Victoria, B.C. He has held the position of assistant chief engineer since 1942. He joined the Department in 1921 as assistant district engineer for Yale District. He was appointed assistant district engineer at New Westminster in 1929 and district engineer in 1931.

George Phelps, M.E.I.C., recently retired as engineer of sewers for the Works Department of the city of Toronto. A life member of the Institute, Mr. Phelps was in the service of the city for many years, joining the department in 1913.

G. P. Wilbur, M.E.I.C., manager of the Ontario Division of Dominion Bridge Company Limited, Toronto, was elected chairman of the Toronto Branch, Canadian Manufacturers Associaton, at the recent annual meeting.

D. O. Robinson, M.E.I.C., of Canada Cement Company Limited, Toronto, Ont., is appointed as chief engineer of the Technical Branch of the company. A graduate in civil engineering of Queen's University, he has been with the technical department of the company since 1930.

J. V. Arpin, M.E.I.C., has entered the services of La Cie Bedard Limitée, L'Assomption, Que., where he will be responsible for organizing production, development and maintenance. For the past six years he had been employed as group superintendent in the shell filling factory at St. Paul L'Ermite, Que.

W. F. Dechman, M.E.I.C., who joined Bowater's Newfoundland Pulp and Paper Mills Limited at Corner Brook, Newfoundland, in March, 1946, has been appointed superintendent in charge of all construction for the company. He will supervise the company's current expansion programme which will increase the capacity of the Bowater Mill at Corner Brook to over 1000 tons of newsprint per day plus 175 tons of sulphite pulp.

J. Edgar Dion, M.E.I.C., will continue his consulting management engineering work under his own name, in Montreal, specializing in organization, personnel, operating efficiency and control, costing administration and selling. Until recently he has been senior supervisory engineer with Stevenson and Kellogg Company Limited, Montreal.

G. W. F. Johnston, M.E.I.C., of War Assets Corporation, Montreal, has been promoted to the position of manager, pricing and distribution divisions. He was formerly assistant manager of the divisions, having joined the corporation in 1944.

R. K. Motherwell, M.E.I.C., is no longer with Canadian General Electric Company at Peterborough, Ont., but is at Leduc, Alta., in the producing department of Imperial Oil Limited.

J. P. Donnelly, M.E.I.C., is chief engineer in charge of engineering products for the Concargo Aircraft Manufacturing Company Limited at Montreal. He was previously executive engineer with Noorduyn Aviation Limited in Montreal.

J. J. Samson, M.E.I.C., is resident engineer for the Rolland Paper Company at St. Jerome, Que. He was previously at Coaticook, Que., in charge of municipal services.

Dr. Karel R. Rybka, M.E.I.C., Toronto consulting engineer has transferred his practice to premises on Bloor Street. Associated with Dr. Rybka is **O. H. Smith,** Jr.E.I.C., who returned some time ago from service overseas with the R.C.O.C.

Jacques L. Dery, M.E.I.C., and **Gerard A. Lapointe,** Jr.E.I.C., have established a firm in Montreal as consulting engineers in steel and reinforced concrete structures, waterworks and town planning, etc.

After war service, finally as second in command of the 2nd Survey Regiment, R.C.A., Mr. Dery returned in 1945 to the Department of Public Works of Canada at Montreal, where he had been employed since 1934.

Mr. Lapointe worked with the Highway department of the Quebec Government, and with the city of Montreal sewers and hydraulic commission. He was construction engineer with McColl-Frontenac Oil Company Limited from 1940 to 1945, and in 1946 he was connected with the National Capital Planning Service at Ottawa.

E. G. DeWolf, Jr.E.I.C., is now employed as assistant plant superintendent of Maritime Industries Limited, Amherst, N.S. He was previously with Standard Chemicals Company Limited in Halifax, N.S., as chemical engineer.

J. H. Merzetti, Jr.E.I.C., was retired in November 1946, from the active force, R.C.E.M.E., with the rank of lieutenant. He is at present employed as a junior supervisor of operations with the atomic energy division of the National Research Council at Chalk River, Ont.

W. D. Barron, Jr.E.I.C., is no longer with the Canadian Underwriters Association, Montreal. He has accepted a position in the Transit Pipe Division of Canadian Johns-Manville in Montreal.

R. A. Frigon, Jr.E.I.C., is now scientific liaison officer in charge of the National Research Council Liaison Office, at Washington, D.C. He was previously regional representative for the Research and Development Branch of the Department of Reconstruction at Montreal, Que.

E. M. Cantwell, Jr.E.I.C., is the newly appointed sales engineer for Darling Brothers, Limited, Montreal. A graduate in mining engineering from McGill University, 1942, Mr. Cantwell spent two years with Consolidated Mining and Smelting Company Limited, Kimberley, B.C., including a period on geological survey work at Yellowknife, N.W.T. After two and a half years in the R.C.A.F. as navigator instructor, he was with Stadler Hurter and Company, Montreal consulting engineers.

W. L. Keay, Jr.E.I.C., began his duties on May 1st as assistant city engineer of Brantford, Ont. A graduate in civil engineering of the University of Manitoba in 1943 he served with the R.C.N. Following discharge he took a postgraduate course in sanitary engineering at the University of Toronto receiving an M.Sc. degree.

J. W. Kerr, Jr.E.I.C., is appointed assistant manager, central station sales for Canadian Westinghouse Company Limited, Hamilton, Ont. A graduate electrical engineer of the University of Toronto, he served with the R.C.A.F., retiring as a squadron leader in 1945, and returning to the Company to be placed in charge of all transformer sales.

A. G. Ballantyne, Jr.E.I.C., is now employed in the engineering department of the Consolidated Mining and Smelting Company of Canada Limited, Trail, B.C. He was with the P.F.R.A. in Calgary, Alta., as junior engineer.

Obituaries

The sympathy of the institute is extended to the relatives of those whose passing is recorded here.

LORNE ARGYLE CAMPBELL

With the passing of Lorne Campbell on April 29th at the age of 76 an exciting chapter in the industrial history of British Columbia was closed. For almost 50 years he has been an intelligent, industrious worker in the mining and smelting industry, specializing in the development of electric power, so essential to the economic expansion of that great enterprise the Consolidated Mining and Smelting Company of Canada Limited. He and S. G. Blaylock who predeceased him by a year and a half were the giants of their time and together built one of the greatest industries in North America.

The story of the utilization of the power of the Kootenay River is indeed the story of Mr. Campbell's life. Beginning in 1898 he has been responsible for each successive development on the Kootenay until today it stands as one of the most efficiently utilized rivers of the world, and a monument to the great man whose vision and driving power made these things possible.

Mr. Campbell was born in Perth, Ontario, March 5, 1871, the son of John G. and Helen Gray (Murdoch) Campbell. He was educated in the public schools and the Collegiate Institute of Perth and joined the engineering staff of the Edison General Electric Company in Toronto on graduation in 1889.

He continued with the Canadian General Electric Company after that firm took over the Edison Company in 1891, and in 1893, at the age of 22, became chief engineer.

In 1898 he left CGE to come west to the new mining community of Rossland and was appointed general manager of the newly-formed West Kootenay Power and Light Company Limited, organized by Sir Charles Ross to build power installations on the Kootenay river for provision of power to the mines of the area.

He was later appointed vice-president of the company and, in 1912, was elected to the British Columbia Legislature for the Rossland-Trail constituency. In 1916 he was appointed to the cabinet of the conservative provincial government as minister of mines.

At the time of his death he was president and managing director of the West Kootenay Power and Light Company, he was also president of the McGillivray Creek Coal & Coke Company Limited and a director of the Consolidated Mining and Smelting Company of Canada, Limited.

In 1903 he married Mary Spahr Hosier, of Jamestown, Ohio, and had one son and one daughter. For almost 48 years he lived in Rossland where he was active in local community welfare, particularly hospitals. He was a member of the Trail Board of Trade, and of Rotary. In 1942 he was vice president of the Associated Boards of Trade of British Columbia.

He joined the Institute in 1935, and in 1946 was awarded the Sir John Kennedy Medal—the senior award of the Institute. Up until shortly before his death he had planned to come to the annual meeting in Toronto for the formal presentation.

W. S. Fetherstonhaugh, M.E.I.C., died on April 17th, 1947, in Victoria, B.C., where he had been residing for two years. He was born at Ottawa, Ont., in 1874, attended school there and worked first in Alberta from 1893 to 1896 as chainman and rodman on Dominion government land survey and irrigation work. He was instrumentman for the Columbia and Western Railway for two years, and worked for the Canadian Pacific Railway from 1899 to 1904 as instrumentman and resident engineer. He was locating engineer for the Grand Trunk Pacific for several years and assistant engineer in charge of construction from 1907 to 1910. That year he was appointed by the Grand Trunk Pacific as district engineer on the National Transcontinental Railway.

Enlisting in 1916 as a lieutenant in the 224th Battalion, C.F.C., he was acting captain in charge of recruiting in Manitoba and Saskatchewan before going overseas. He was demobilized in 1919 with the rank of lieutenant-colonel, after four mentions in despatches and with the C.B.E. decoration. That year he returned to the Grand Trunk Pacific as division engineer at Prince Rupert, B.C., and transferred to the Canadian National Railways at Calgary, Alta.

Mr. Fetherstonhaugh joined the Institute as an Associate Member in 1907, becoming a Member in 1914. Life membership was awarded him in 1939.

H. A. Moore, M.E.I.C., died at his home in Trenton, Ont., on March 19th, 1947. He was born at Hamilton, Ont., in 1871, and studied at the University of Toronto, graduating in 1893 with a B.A. degree. He then entered the engineering department of the Canadian General Electric Works at Peterborough, taking the student course, and in 1895 was made assistant to the works engineer. In 1896 he became general superintendent for the Trenton Electric and Water Company at Trenton and Belleville, Ont., and in 1901 he returned to the Canadian General Electric Company at Toronto as estimating engineer. He was district manager for the Canadian Bullock Electric Manufacturing Company at Toronto in 1903-4 and then came to Montreal as assistant to the president of Allis Chalmers Bullock works. In 1906 he went to the Dominion Engineering and Construction Company, Limited, Montreal, as general manager. He went to the Calgary Power Company in 1912, was later connected with the English Electric Company of Canada Limited at Toronto for some years, and practised as a consulting engineer in Toronto until he accepted in 1937 an appointment with the engineering department of the Consolidated Mining and Smelting Company of Canada at Trail, B.C. He left Trail in 1944 to take up residence again in Trenton.

An enthusiastic yachtsman, especially interested in lake racing, he was judge in 1930 of Canada's cup contest and chairman of the sailing committee of the Royal Canadian Yacht Club. He is credited with having organized Canada's cup race competitions within the framework of the Canadian Yachting Association.

He joined the Institute as a Member in 1907, and was awarded Life Membership in 1937. He was Chairman of the Toronto Branch of the American Institute of Electrical Engineers in 1905.

George Rixon Hill, M.E.I.C., who was with the Department of Transport at Port Arthur, Ont., since 1942, died on April 6th, 1947. Born at Peterborough, Ont., Mr. Hill received his early education at Renfrew, Ont. He served on railway location work with the Canadian Pacific Railway in the west, and on road surveys for the Manitoba Good Roads Board. He was employed as municipal engineer at Virden, Man., for nineteen years prior to his service with the Department of Transport in 1936. He served as district airway engineer with the Department at Sioux Lookout and Nakina, Ont., and came to a similar position at Port Arthur in 1942.

Mr. Hill joined the Institute as a Junior in 1917, transferring to Associate Member in 1931 and to Member in 1940. He was a member of the Manitoba Association of Professional Engineers.

P. B. Roberts, M.E.I.C., of Eltham, England, died on January 3rd, 1947. Born in London, England, in 1877, he studied under C. W. Bevis, surveyor of Portsmouth, and later served as his assistant. He was with the Works Department of the Portsmouth dockyard as a draughtsman and later served in the Royal Engineer's Office at Isle of Wight as a surveyor's assistant. He was surveyor and chief assistant to the commanding officer for five years at Bulford Camp, Salisbury.

Coming to Canada he joined Messrs. Burke and Horwood, Toronto, serving as an inspector in charge of all outside work in 1906 and 1907. Then for seven years he was with the Grand Trunk Railway. He was in charge of construction of works at London, Ont., station foundations at Ottawa, Ont., the bridge over the Yamaska River at St. Hyacinthe, Que., and later became chief draughtsman and engineering architect for the company in charge of all building work on the railway, which brought him to Chicago, Buffalo, Detroit, Ottawa and Montreal.

He returned to England in 1915 to take up war service and was for four years surveyor on the staff of the Royal Arsenal at Woolwich. He was superintending surveyor for the Royal Ordnance Factories of the Royal Arsenal from 1928 until his retirement in 1942. He visited Canada in 1940 as a government official to advise on the building of the Cherrier shell filling plant in Montreal.

Mr. Roberts joined the Institute in 1919 as a Member.

Peter James MacDonald, M.E.I.C., of the town of Mount Royal, Que., passed away at his home on April 11th, 1947, after a brief illness. He was born at Loch Garry, Glengarry County, Ont., in 1879 and studied applied science at McGill University. He worked first on construction with the Dominion Bridge Company in New Brunswick and then with the Canadian Pacific Railway in Manitoba from 1904 to 1908. After a few years contracting at Fort William and later at Swift Current, Sask., he set up practice as a municipal engineer at Swift Current. In 1930 he became district engineer for the Department of Highways at Swift Current, and in 1935 district engineer for the P.F.R.A. In 1937 he came east to work with the Department of Highways in Northern Ontario. His last active work, prior to his retirement was in charge of the proportioning of concrete on the Shipshaw project.

Mr. MacDonald joined the Institute in 1919 as an Associate Member, becoming a Member in 1940 and a Life Member in 1946.

Edward Floyd, M.E.I.C., director of West Coast Collieries, Vancouver, B.C., died recently. Born at Yorkshire, England, in 1874, he studied science in England and worked first with the Ashington Collieries in Northumberland. He served from 1905 to 1915 as consulting engineer for the Miners Executive Committee and Federation of Great Britain and in 1915 he joined the Royal Army Medical Corps. Returning after discharge in 1917 to his former position, he was loaned to Canada and was engaged to make valuations of the operating coal mines and the undeveloped coal areas. From 1920 he practised privately in Vancouver, acting as consultant to various mining and industrial firms in the province. He returned to England in 1930, but he was back in Vancouver in 1933 as general manager of Maple Leaf Iron Works and in 1935 he was elected director, as mining engineer on board, and consulting mining engineer to the West Coast Collieries.

Mr. Floyd joined the Institute as a Member in 1943.

NEW HONORARY MEMBERS OF THE INSTITUTE

The following are the citations read at the Annual Banquet in Toronto upon presentation of the certificates to the four new Honorary Members of the Institute.

ERNEST BROWN

"The hydraulic resources of Canada are large. Their industrial development is a matter of vital importance. Tonight we honour a man who has made outstanding contributions to this development and to the development of engineering knowledge covering a wide range of activities. His investigations in the field of reinforced concrete are notable. He had an important share in the difficult special studies carried out in connection with the design of the Quebec Bridge, and his experiments and researches on the strength of ice have added greatly to the engineer's knowledge of this troublesome substance in relation to his structures and machines. Of notable importance, too, have been his studies, pursued over many years, on model turbine runners.

"At the same time he has carried a heavy load of responsibilities on the staff of the faculty of engineering at McGill University, serving as dean for many years.

"He has taken an active part in the affairs of The Engineering Institute of Canada, giving liberally of his time to its interests. In 1909 and again in 1915 he received the Gzowski Medal for outstanding contributions to the literature of the profession. In 1942 the University of Toronto conferred on him the degree of Doctor of Engineering.

"Today, in recognition of his attainments as an engineer and educationalist, the Council of The Engineering Institute of Canada is conferring upon him an honorary membership."

PERCY DUNSHEATH

"In the field of electrical engineering our confrere has made outstanding contributions that have had far-reaching effects in many parts of the world. One of the most spectacular, a contribution of vital importance to the war effort, was the development of buoyant cables for sweeping magnetic mines, utilizing cylindrical so-called 'tennis balls' to form the buoyant centre for the cables.

"Of great importance, too, though not so spectacular, have been the many improvements that he has effected in the design and manufacture of electric cables, particularly in the supertension field. For these and other contributions he has brought honour to himself and to his native England. For instance, it is of interest to note that Dr. Dunsheath was the pioneer of the continuous extrusion process for producing lead pipe and was the inventor of the first machine to operate successfully on this principle. He is the author of many papers and articles on electrical engineering, physics, the organization of research and education in industry.

"In 1946 he was president of that great society, The Institution of Electrical Engineers, and in that capacity greatly honoured The Engineering Institute of Canada by attending the annual meeting in Montreal, representing also the Institutions of Civil and Mechanical Engineers.

"Today, in recognition of his outstanding contributions to the field of engineering and to his leadership, the Council of the Engineering Institute is conferring upon him an honorary membership."

C. J. MACKENZIE

"As a pioneer consulting engineer and educationalist in the Canadian West our distinguished past-president early in life evidenced a talent for leadership that carried him to great heights in the Canadian engineering, scientific and educational field.

"While still a young man he inaugurated the engineering courses at the University of Saskatchewan. As dean of the faculty he brought engineering education there to a level that has added a touch of distinction to Saskatchewan graduates ever since.

"As acting president of the National Research Council and later as president, he rendered a vital service to the national effort and contributed much to international scientific achievement.

"In addition to his duties as president of the Research Council he is director of industrial research and development in the Department of Reconstruction. He has made many valuable contributions to the work of other organizations concerned with the advancement of engineering and scientific knowledge.

"Few men in Canada have had greater responsibilities on their shoulders, and none has met them with greater success than the gentleman we honour this evening. Unfortunately for him the war's end did not bring an end to the emergencies that have faced him for so many war years. One of Canada's greatest opportunities and responsibilities still lies heavily upon him—the atomic energy project at Chalk River. It is fortunate for us all that he is here to guide it.

"He is a past-president of The Engineering Institute of Canada.

"Today, in recognition of these outstanding attainments, the Council of The Engineering Institute of Canada is conferring upon him its highest honour—honorary membership in the Institute."

F. H. SEXTON

"The wide range of activities that it is possible for an engineer to encompass are well illustrated in the career of our next candidate. His accomplishments, the recognition he has earned in his diversified public activities and the esteem with which he is held by all who know him, have done much to enhance and add lustre to the entire profession.

"In the field of engineering education he has attained a pre-eminent position. He has been responsible for the building and development of the Nova Scotia Technical College at Halifax from its inception in 1907 to its high attainments of today. The great majority of engineers who have come from Canada's maritime provinces for the past forty years have passed through his competent hands. He has been director of technical education for Nova Scotia since 1907.

"In addition he has served with many organizations and public bodies, some of whose activities range rather far from the field of engineering as we usually think of it.

"Today, in recognition of these many contributions, the Council of The Engineering Institute of Canada is conferring upon him an honorary membership."

News of the Branches

Activities of the Twenty-eight Branches of the Institute and abstracts of papers presented

BORDER CITIES BRANCH

G. W. Lusby, m.e.i.c. - - *Secretary-Treasurer*
W. R. Mitchell, m.e.i.c. - *Branch News Editor*

On Friday evening, April 11th, 1947, the Border Cities Branch of the Institute held its monthly meeting at the Prince Edward Hotel, Windsor, Ontario.

A very interesting talk on **Radiant Panel Heating** was given by J. S. Mitchener of J. T. Wing & Company Limited, Windsor. The subject matter, being of a very interesting nature due to the problems of heating caused by increased costs, etc., led to one of the most lively question and answer periods that the Branch has seen in a long time.

Mr. Mitchener sketched the history of Radiant Heating from the time of the large built-in fireplaces in England, and considered the temperature of rooms having a fireplace wall in them but no open fire. He discussed the present day applications for floor-heating, wall heating and ceiling heating.

Most of the members present were surprised to hear that, although there are not many installations in Canada at present, the Border Cities area has shown the largest development in this type of heating installation.

The talk was well illustrated by means of slides showing several types of installation coils, both floor and wall types.

HALIFAX BRANCH

J. D. Kline, m.e.i.c. - - *Secretary-Treasurer*
M. L. Baker, m.e.i.c. - - *Branch News Editor*

The April meeting of the Branch was held at the Nova Scotian Hotel on April 17. E. C. O'Leary, Chairman of the branch, presided. Members and guests numbered one hundred. Among the guests present were Hon. A. L. MacDonald, Premier of Nova Scotia; and Mr. A. M. MacKay, general manager of Maritime Telegraph and Telephone Company, and president of the Halifax Board of Trade.

Bridge over the Strait of Canso was the topic of the address given by Mr. Charles P. Disney, consulting engineer and vice-president of Intrusion-Prepakt, Limited, formerly chief bridge engineer with the Canadian National Railways. In view of the timeliness of the subject, a number of members of the Halifax Board of Trade was invited to hear the address.

Mr. Disney's proposed method of building the bridge involves the use of a patented new type of concrete construction of piers in conjunction with steel H-piles. He anticipated no problems with ice, tides or deep water. The cost of constructing the piers by this method would be, according to the speaker, a great deal less than if built in the conventional way.

Mr. Disney illustrated his talk with slides showing the procedure involved in using this method of concrete construction both on new projects and in repair work.

The number of questions asked of the speaker during the discussion period was an indication of the interest of his listeners.

Following the discussion, a vote of thanks was moved by Dr. Cameron, Deputy Minister of Mines of Nova Scotia, and president-elect of the Nova Scotia Technical College, and seconded by J. R. Kaye, president of Engineering Service Limited.

KINGSTON BRANCH

J. E. Thom, m.e.i.c. - - - *Secretary-Treasurer*

Four interesting papers were delivered before the Kingston Branch on February 24, 1947, by undergraduate students of the faculty of applied science, Queen's University, on the occasion of the Annual Student Papers Competition.

W. H. Finch, s.e.i.c., took first prize with his paper **Long Distance Radio Propagation** in which he dealt with long range communication by radio waves, the effect of the ionized layers of the stratosphere, the regular and irregular variations of these layers and the further problems to be investigated in this field of activity.

A. E. Fee, s.e.i.c., was awarded second place for his paper dealing with **Radar** in which he discussed various types of radar equipment and their applications.

Third prize was given to W. R. Anderson, s.e.i.c., for his paper on **Rubber** in which he discussed the history and production of natural rubber, the various types of synthetic rubber and compared the properties of each.

The fourth paper was presented by J. G. S. Billingsley, s.e.i.c., who also spoke on **Radar** dealing particularly with certain land stations, outlining their construction, operation and range.

The judges, Colonel A. Walker, Department of English, Queen's University, M. G. Saunders and A. Narduzzi, Engineering Society, Queen's University, reported briefly on the reasons for their decisions. They stated that the high quality and good presentation of all papers had made their task very difficult.

While the judges were deliberating the National Film Board film " Salmon Run " was shown to the audience through the courtesy of A. L. Crossland, Personnel Department, Nylon Plant.

On April 9th, Mr. R. M. Doull of the Canada Gunite Company, Montreal, presented a paper on the **Reconstruction of the Halifax High Service Reservoir.** Mr. Doull's clear and informative talk dealt with the rebuilding of a 30-year-old, heavily reinforced concrete structure in Halifax, and was much appreciated by the members.

LONDON BRANCH

A. L. Furanna, m.e.i.c. - - *Secretary-Treasurer*
G. N. Scroggie, m.e.i.c. - - *Branch New Editor*

The regular monthly meeting of the London Branch was held on the evening of March 27th in the London city hall, with H. A. McKay presiding.

The Chairman introduced the speaker of the evening V. A. McKillop, assistant general manager of the London Public Utilities Commission, who spoke on **The Proposed Change in Frequency in the Niagara System of the H.E.P.C.**

" The advantages claimed for the change from 25 to 60 cycles should be carefully weighed against the costs," said the speaker. " The selection of 25 cycles in the early part of the century was made for good and sufficient reasons, and neither blame nor credit should be attached to any member of the H.E.P.C. since decisions were made and power generated at 25 cycles before the Commission came into the market as a purchaser."

In 1888 Mr. George Westinghouse entered the electrical field in the United States, using a belt-driven A-C generator and a frequency of 133-1/3 cycles per second. In 1898, direct-coupled engine-type A-C generators were adopted and this necessitated the use of a lower frequency and 60 cycles was accepted as most suitable, and in time became the " standard frequency ".

When the Niagara Falls Power Company started their No. 1 Plant on the American side of the Falls, a consulting engineer recommended a frequency of 16 2/3 cycles. Mr. George Westinghouse, however, advised that he would not manufacture and guarantee any machine of a frequency lower than 25 cycles, and hence this was adopted as a second standard of frequency.

The installed generating capacity for this Niagara Falls District is 1,017,000 kva., and the investment in generation and transmission is approximately $200,000,000. In addition, the H.E.P.C. has contracts for 575,000 kw. of 25-cycle power with power companies in the Province of Quebec.

After outlining the history of power generation in the province, Mr. McKillop went on to give arguments pro and con on the proposed change-over from 25 to 60 cycles. Twenty-five cycle regulation is better, there being less voltage drop than on a 60-cycle line, which means that there would have to be more transmission lines for the higher frequency. Heavy industries prefer low speed induction motors that operate on 25 cycles.

New equipment and appliances developed in the United States for 60 cycles are not available here for a considerable period of time, and American industrial firms would like to locate branches here and be able to standardize their equipment with that of the home plant. Sixty cycles means less flicker, although fluorescent lighting is being adapted to 25 cycles. Sixty-cycle motors are smaller and cheaper, but not sufficiently so to affect the price of such appliances as refrigerators and washing machines. Sixty-cycle generators in the small sizes are cheaper and less bulky than 25-cycle generators, while 60-cycle transformers cost about 1/3 less and weigh about 20 per cent less than the 25-cycle transformers.

The cost of the change in the City of London has been estimated at $4,500,000. About one-third of this would be required for the distribution system and the balance on the consumers' premises. The estimated cost for changing the equipment in the average household would be about $75. The speaker explained how the change could be gradually brought about, and a question period followed.

Mr. McKillip was thanked by W. J. Bright.

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On Tuesday, May 6th, the Branch held a dinner meeting at the Y.M.C.A., and Mr. Ralph C. Manning, chief engineer of the Canadian Institute of Steel Construction, was the speaker of the evening.

H. A. McKay was in the chair and introduced the speaker who chose as his subject, **Steel in Small Houses.**

Mr. Manning spoke briefly on the development of this light steel section which is rolled in the shape of a channel. The channels come in various depths but have a constant flange width, and gauge. He explained how those members can be employed as rafters, joists and studdings in fire resistant construction, and then presented a film showing the actual construction of a home near Hamilton. This was the first such home erected and the floors were pre-fabricated in sections and shipped ready for use. The speaker went on to say that a second house had been constructed satisfactorily, using the members as they came, no prefabricating being done in the shop.

After the showing of the film, Mr. Manning showed a piece of this new section and answered several questions.

The speaker was thanked by Mr. A. Joedicke.

MONCTON BRANCH

V. C. Blackett, M.E.I.C. - *Secretary-Treasurer*

On March 12th, the Moncton Branch was favored with an official visit from the president of the Institute, Mr. J. B. Hayes. The President was accompanied by Mrs. Hayes, Councillor and Mrs. G. J. Currie, and Assistant General Secretary Louis Trudel. The presidential party was met at the station by members of the branch executive and their wives. Later in the afternoon, they were taken on a sight seeing tour. This included a visit to the plant of the Moncton Ice Company where the complete cycle of operations in the manufacture of artificial ice was shown; then to the Marven Biscuit Factory, and finally to the Moncton Airport.

In the evening, a dinner meeting was held in the Palm Room of the Brunswick Hotel. G. L. Dickson presided and introduced Mr. Hayes. In his address, the president declared that education is the greatest problem in Canada today. There is need for more engineering teachers with salaries higher than at present. They should have more time for research in pure science. Other speakers included Mayor G. F. G. Bridges, G. J. Currie, Louis Trudel, W. C. MacDonald and A. S. Gunn. During the course of the dinner, two enjoyable solos were sung by Corey Smith.

After the meeting, a reception for the visiting ladies was held at the home of Mrs. T. H. Dickson and attended by the wives of branch members.

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On April 9th, E. D. Bent, cable development engineer, Northern Electric Company, Montreal, addressed a branch meeting, taking as his subject, **The Role of Synthetics in the Design and Manufacture of Electric Cables.** Mr. Bent described the various substitutes that had been developed during the war, to take the place of natural insulating materials, notably rubber and silk. A vote of thanks was moved by T. H. Dickson and seconded by J. A. Godfrey.

MONTREAL BRANCH

E. M. Van Koughnet, M.E.I.C. - *Secretary-Treasurer*

A conference of branch officers was held at the recent annual meeting at Toronto. It was well attended and many points of common interest were discussed. The feeling of those present was that the conference had been well worthwhile and should become a feature of future annual meetings. The Montreal Branch was represented by J. M. Crawford, chairman and R. N. Coke, vice-chairman.

About 100 members of the Montreal Branch attended the annual meeting. Dr. Massue's charts on membership created considerable interest and it is hoped that these charts will be available to show the members of Montreal Branch later in the season. The Annual General Meeting Committee of the Toronto Branch is to be congratulated on its organization of a thoroughly successful annual meeting.

The branch House Committee reports as a result of its suggestion to the Institute House Committee that certain changes at Headquarters will be carried out in order to better serve the needs of the Branch. It is hoped that these changes will be in effect by the autumn of this year. The Institute House Committee is considering the possibility of effecting major changes at Headquarters in order to better serve the membership at large. However, it is expected that it will be some time before any major changes will be undertaken.

The Montreal Branch extends its congratulations to the following on their election to Council:

R. S. Eadie, Vice-President, K. G. Cameron, Councillor,
J. A. Beauchemin, Councillor, C. E. Gélinas, Councillor.

Congratulations are also extended to the following on their election to the Council of the Corporation of Professional Engineers of Quebec:

J. B. Stirling, Vice-President, J. A. H. Henderson, Councillor,
J. A. Lalonde, Secretary-Treasurer

OTTAWA BRANCH

C. G. Biesenthal, Jr.E.I.C. - *Secretary-Treasurer*
R. C. Purser, M.E.I.C. - - *Branch News Editor*

At an evening meeting held at the Auditorium of the National Museum on April 16 an illustrated talk was given on the **Reconstruction of the Halifax High Service Reservoir** by R. M. Doull, M.E.I.C., Montreal. Major-General G. R. Turner, chairman of the Branch, introduced the speaker and occupied the chair.

The speaker told how a pre-stressed concrete shell, 2½ in. thick and 164 ft. in diameter, was built to cover a reservoir at Halifax. Originally constructed in 1917, the reservoir had to be rebuilt recently. Its original capacity had been reduced from 3½ million gallons to 2 million gallons with consequent fire danger to the city. When the reservoir was rebuilt, it had a capacity of 4 million gallons.

Mr. Doull asserted that the job resulted in the largest roof of its type in the world. Waters from nearby lakes feed the reservoir through a pumping system and run into the city down a slope. No columns were used in the construction. The tank is 25 ft. deep.

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At a noon luncheon at Standish Hall, Hull, on April 24, Dan Gasper, manager of the Canada Cement Plant at Hull, spoke on **Safety Calling Leadership.**

The amount of money lost in accidents in Canada annually would provide $10,000 homes for every family in a city larger than Hull, stated Mr. Gasper.

Addressing his plea of "Safety Calling Leadership" to engineers, "who blazed a trail across the wilderness only to meet the demon of accident", he said that the world has failed to keep up with preventative methods. Man has developed much in science and the production line but has forgotten human relations.

"This has resulted in God's chosen creature, man, playing a minor role to machines", he declared. "I see fear creeping into the industrial home. Much has been done to eliminate dangerous hazards, and it provides us with the incentive to complete the task."

"The hard-boiled captains of industry, who scorned safety flags and crests, have disappeared", he continued. "In their place are men who believe in cooperative effort and in the stimulation of men and minds."

"Canadian youth goes through two of the greatest institutions in existence, the home and the school", Mr. Gasper said, "yet he still knows nothing about safety when he applies for a job. We try now to make them safety-conscious in their industrial home, where one-third of their lives is spent."

He stressed, however, that safety-consciousness must apply to both the home and the plant. Of 100,000 accidental deaths annually in the U.S., 30,000 occur in the home.

Benefits of a safety campaign are twofold. First, the saving in money alone justifies such a programme. Secondly, excellent public relationship results that goes far to reduce labour-management strife.

J. H. Irvine, immediate past chairman, presided in the absence of Major-General G. R. Turner, chairman.

PETERBOROUGH BRANCH

A. R. Hailey, M.E.I.C. - - *Secretary-Treasurer*
J. C. Allan, M.E.I.C. - - *Branch News Editor*

Mr. C. R. Whittemore, research metallurgist for the Deloro Smelting and Refining Company, presented a paper on **Cobalt** before the Peterborough Branch on the evening of April 3rd.

Mr. Whittemore informed the branch that cobalt is a versatile metal of considerable importance. It is used to impart strength and high temperature hardness to steel alloys. It has also a great variety of other uses, ranging from paints and ceramic stains to catalysis and fertilizers.

The Belgian Congo is the world's chief source of cobalt as a by-product from the treatment of the copper ores found there. Canada is the chief North American source for cobalt. It is also obtained from Northern Rhodesia, British India and French Morocco. During the War the Deloro Mining & Smelting Company processed ores from all of the principal sources, and in fact was the principal source of the refined forms of this critical material for the United Nations.

The most important use of cobalt is in stellite, which contains cobalt, chromium, tungsten and small amounts of other metals. Stellite is used for high speed cutting tools, hard surfacing compositions and other applications requiring corrosion and heat resistance. Certain steel alloys contain cobalt to impart toughness and hardness at high temperatures. Many of the best magnetic alloys contain cobalt.

The earliest known uses of cobalt were by the Egyptians—some 3,000 years ago. They used cobalt to colour glass and statuettes blue. It was also used for pottery decorations by the early Persians, Assyrians, Arabians and Chinese.

Cobalt oxide is still employed as a stain for ceramic bodies to offset the yellow stain imparted by traces of iron in the clays used for whiteware. It is also used in glazing, where in combination with oxides of manganese, nickel and chromium, all shades of blue and green glazes can be obtained. Cobalt is also used in catalytic driers for paints and varnishes. Cobalt chloride and cobalt sulphate improve many soil fertilizers and certain soluble cobalt salts may be fed directly to animals to improve their diet. When cobalt 59 is exposed to neutron bombardment in an atomic pile, it becomes radio-active, and only drops to one-half its initial strength after five years. For certain purposes it may be superior to radium and free us from dependence on radium for therapeutic purposes.

The name *Cobalt* was derived from the German name *Kobold* for gnomes and goblins. It was applied by German miners to cobalt ores, which had a bad effect on their health due to arsenic content.

Following the presentation of the paper, Otto Laderach, a former naval officer, rose and thanked Mr. Whittemore for assistance which he had received from him in making urgently needed repairs to vessels at a critical time. Mr. Laderach described some of Mr. Whittemore's metallurgical products in glowing terms, and intimated that they had enabled him to surmount great difficulties in getting damaged ship machinery back into service.

J. M. King, laboratory metallurgist for the Canadian General Electric moved a vote of thanks, and also acknowledged a debt for advice from Mr. Whittemore on metallurgical problems.

SAGUENAY BRANCH

J. E. Dyck, M.E.I.C. - - - *Secretary-Treasurer*

Junior Section

T. T. Anderson, Jr.E.I.C. - *Secretary-Treasurer*

A meeting of the Junior Section of the Saguenay Branch of the Institute was held at the Saguenay Inn, Wednesday evening, April 9th.

A. H. Johnston of the Aluminum Company of Canada, Limited, delivered an interesting address on the subject of **Engineering in Cellulose Acetate Manufacture.** He presented slides showing flow sheets and pictures of equipment used in a similar plant in the U.S.A. The process, up to the production of dry cellulose acetate powder, was discussed in more detail, Mr. Johnston having been attached to the engineering department servicing that section.

Although no details were given, it was intimated that Canadian Celanese Limited had developed specialized equipment to handle the various operations in the production of dry acetate powder. Routing of materials to finished dyed fabrics was also discussed.

Samples of materials used in the process as well as finished fabrics, loaned by Canadian Celanese, Limited, were displayed to the general interest of the audience.

The speaker was introduced by J. T. Madill, chairman of the Junior Section, and thanked by J. P. Estabrook.

Following the talk, coffee and sandwiches were served to the assembled company.

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A meeting of the Junior Section of the Saguenay Branch of the Institute was held in the Banquet Hall of the Saguenay Inn at 8.15 p.m., Wednesday, April 30th.

G. K. Clement of the Aluminum Company of Canada Limited spoke on the subject of **Glass Lining of Tanks** as practiced by the John Inglis Company of Toronto.

Mr. Clement dealt first with the design considerations of a tank suitable for glass lining, covering such points as type of steel, shapes, variations in section thickness and strengths at elevated temperatures. Preparation of the glass was discussed, together with its characteristics and peculiarities.

A detailed account was given of the application and firing of the glass, and the requirements of atmosphere control, exacting cleanliness, and inspection. The properties, advantages and application of glass lined storage vessels were also outlined. The lecture was illustrated with slides.

An interesting discussion period followed the talk.

Mr. Clement was introduced by C. J. Tanner and thanked by T. T. Anderson.

SAINT MAURICE VALLEY BRANCH

W. R. Mackay, Jr.E.I.C. - *Secretary-Treasurer*

The Annual Dinner Meeting of the Branch was held at Laurentide Inn, Grand'Mère, on Thursday evening, April 17th. The special speaker for the evening was Guy Rinfret, whose subject was **Hydro-Electric Power Developments in China.** Mr. Rinfret had spent three months in China last fall, investigating power sites for the Chinese Government. During that time, he travelled over 4000 miles in that country, and his address was extremely interesting. The address was illustrated by slides and a discussion period followed in which everyone had a chance to question the speaker.

The business part of the meeting followed. The Treasurer read a brief summary of the financial statement for the year. Then the results of the branch by-election were announced and the officers for the coming year installed in office.

Attendance at the meeting was fifty-four.

SARNIA BRANCH

F. F. Walsh, M.E.I.C. - - *Secretary-Treasurer*
J. S. Pickering, S.E.I.C. - *Branch News Editor*

The first informal evening meeting of the Sarnia Branch for 1947 was held at the Lutheran Hall on March 27th. A portrayal of the extensive amount of work entailed in laying the petroleum carrying pipelines across the English Channel was shown as a feature of the evening in the form of a movie entitled "Operation Pluto", sponsored by the Drummond-McCall Company.

A lively discussion preceded the movie during which D. S. Simmons, chairman of the Special Projects Committee outlined work that had been done by various interests towards Town Planning for Sarnia. A resolution was passed that the Sarnia Branch should offer its services to the Sarnia, Point Edward and Township Councils, and the Chamber of Commerce, towards a combined effort in the study of future planning.

An editorial in the *Sarnia Canadian Observer*, which was rather critical of an editorial reprinted on the same page from the *Journal*, was discussed. It was decided that further action if any should be left to the executive. The editorial concerned the recent resignation of Dr. Hogg from the Hydro, ıd in general the position of the engineer in administrative ›sitions.

A dinner meeting was held in the Polymer Cafeteria on ›pril 24th at which A. H. Frampton, director of engineering r the Hydro, was guest speaker. He was introduced by G. R. enderson, and his topic was the **Romance of Niagara Power.**

Mr. Frampton sketched the growth and development of ydro from its inception and also outlined the geological story of the Great Lakes and the Niagara area in particular.

He went on to discuss the controversial issue of the change-·er in frequency for Southern Ontario, and it appeared that everyone knew the facts as presented by Mr. Frampton, a eat many of the arguments against the change, particularly regard to the uncertainty of the financing, should disappear.

The main issue as to whether the change is economically stified is being studied by a committee at the present time. e estimated cost of $200,000,000 was emphasized as including e total cost of the undertaking; that is, it includes the cost converting the facilities of the provincial Hydro system, the unicipalities, and the domestic consumers. He pointed out at the Hydro had built up a surplus of $32,000,000 during e war period which might increase to a possible $60,000,000 a short time with the present rate structure. This amount ›uld probably be used in helping to finance the venture.

He explained how, in many cases, equipment would be re-aced with new equipment, and in addition the consumer ould be able to purchase 60 cycle equipment at lower cost.

Mr. Frampton also discussed the possibility that, if the ange-over is not made now, there might come a time in the ture when, after many more dollars have been spent on ‹ cycle facilities, the change might be found to be necessary?

The 60 cycle system would have greater efficiency in the stribution of power, as much as 40,000 kw. being saved in ıe district alone. In an area such as Sarnia where there are ·ospects of wide industrial expansion, the advantages of ıving 60 cycle power to offer are manifold, particularly as ost industrial equipment would otherwise have to be designed.

There is much to be said in favor of standardization, espe-ally in an emergency such as recently occurred during the st war when England considered herself fortunate to have andardized the cycle just before the war.

The totally unexpected increase in power consumption has ıught everyone off balance just at a time when a breathing ›ace was looked for.

In short, the speaker concluded that now appears to be the est time for a change.

E. W. Dill expressed the thanks of the Branch to Mr. 'rampton.

The next meeting was announced as the Annual Junior leeting on May 14th. This would take the form of a smoker t which several of the Junior members would present papers.

VICTORIA BRANCH

S. H. Frame, M.E.I.C. - - *Secretary-Treasurer*
K. Reid, M.E.I.C. - - - - *Branch News Editor*

The Canol Pipe Line was the subject of an address given ›n April 10 to 50 members and interested engineers of the 'ictoria Branch by Major General W. W. Foster, C.M.G.,).S.O., member of the B.C. Power Commission.

General Foster was appointed as liaison officer representing he Canadian Government on the various North West projects ınd has a wealth of first hand knowledge on the construction ›f both the Alaska Highway and the Canol Pipe Line. His ıddress was illustrated by two reels of coloured motion picture ilm depicting the construction from start to finish. These pic-ures were taken by the U.S. Army signal corps, and were ›resented to General Foster on completion of the project in ıppreciation of his active participation. This was the third ime the pictures have been shown in Canada.

The Canol Pipe Line project was conceived by the U.S. Government to ensure a safe supply of vital gasoline and ›etroleum products following the construction of the North West staging route and the Alaska Highway since by 1942, the Japanese war strategy in the Aleutians and on the Pacific Coast had virtually cut off supplies by the water route from California to Alaska.

The land haul was from Edmonton to Nome via Whitehorse and Fairbanks, a distance further than from Edmonton to Ottawa, and included 1,600 miles of Alaska highway together with 1,500 miles of subsidiary roads constructed in conjunction with the highway. A preliminary survey proved the oil fields at Norman Wells on the McKenzie River to be major fields capable of producing 3,000 barrels of oil per day. With the cooperation of the Canadian Government the Canol project was proposed as part of the whole north west scheme. The word *Canol* is an abreviation for *Canadian Oil.* The whole plan, the N.W. staging route, the Alaska Highway and the Canol Pipe Line constituted the largest construction project in the history of the world.

The presence of oil on the McKenzie River had been known for many years. The Imperial Oil Company had operated a refinery at Norman Wells for 5 months of the year, producing 950 barrels per day. This oil had a very high paraffin base and a viscosity that would allow flow at a temperature as low as 70 deg. F. below zero. The distance from Norman Wells to Whitehorse on the Alaska Highway was about 600 miles across two mountain ranges of 5,500 feet altitude through country much of which had never before been explored by man.

In the summer of 1942 some 2,500 engineer troops proceeded the 1,200 miles from Edmonton to Norman Wells; 60,000 tons of freight were necessary for construction of the project. Time was an essential element. Transportation at first was by barge and boat on the water route down the McKenzie River. A winter road was built to Norman Wells for use after freeze-up. Fifteen thousand Canadian civilians and 7,500 Americans were employed on the project. Construction commenced from the Norman Wells end only, but later, when the Japs were driven from the Aleutians, construction proceeded from both ends in order to speed up completion of the project. Ten pumping stations were required for delivery of the oil over a four-inch steel pipe line of welded construction, laid on the surface of the ground and following the contours of the topography. Tank storage and tank farms were constructed at various points including the Alaska Highway. The whole project took 21 months to complete and 3,000 barrels per day were delivered from the 4,000 barrels of crude oil per day produced from 63 wells at Norman Wells. The first oil was delivered within 24 hours of the scheduled date. By March 1945 over 2,000,000 barrels had been produced and 1¾ million barrels refined at the refinery built at Whitehorse.

After the first year of operation refined oil could be brought safely and more economically by water from California to Skagway and with less use of man-power, and operation of the project was curtailed.

The pipe line and refinery are still in use, however, and will continue to be employed to a limited extent. The oil field at Norman Wells has a conservative estimated reserve of over 40 million barrels. Prospecting of the country is proceeding as it is considered that a reserve of some 300 million barrels would be required to make extensive production commercially economical. Meanwhile a vast potential worth has been created and developed for future use.

The Canol pipe project was a valuable insurance against Japanese attack for at least 12 months and probably changed the course of the war. As General Marshall summed it up, because of the action taken by the United States and Canada the course of the war was changed and if its duration was shortened by only one day the cost was justified.

The experience gained through this huge development shattered forever the myth of a barren and inhospitable Northland. By May of this year a new air route from this continent to Asia is to be inaugurated by way of the North West and Alaska. The development of this area has served its purpose in time of war and will have an ever increasing value in time of peace.

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The regular monthly meeting of the Victoria Branch of the Institute was held Thursday evening, March 13th at the Little Centre in Victoria with about 50 members and guests in attendance.

The speaker for the evening was the chairman of the local branch, Major. R. C. Farrow, comptroller of water rights for the Province of British Columbia, who spoke on **The Work of Artillery Survey Regiments in the Late War.** Major Farrow was second in command of the Second Survey Regiment, R.C.A., during operations in north-west Europe.

The speaker gave a brief outline of the development of artillery survey work during the First Great War, out of which were developed Survey Regiments as a part of the Royal Artillery. The organization, training of men and type of equipment used by these regiments in the late war was described.

"Artillery survey" said Major Farrow, "is hard to compare with ordinary civilian survey. It first appeared cumbersome and overmanned but—we have to admit that the elaborate and formalized set-up had a very real purpose. It was designed to produce results under any conceivable condition in the shortest possible time with highest possible accuracy."

The sciences of flash-spotting and sound-ranging were described in detail and proved to be of considerable interest to the engineer.

Flash-spotting is essentially cross-observation by instrumental methods, using specially designed binocular theodolites from accurately surveyed posts commanding a good field of view. By observing the gun flash the bearing and range of the gun location could be obtained, usually after the second flash.

Sound ranging is similar to the above, but employs sound rays instead of visual ones. Its great advantage lies in independence of visibility. Accurate meteorological data is essential for sound ranging, as wind will alter the amplitude of sound. The sound waves are picked up by a series of microphones in succession, recorded on film with marked time intervals, read off and plotted by rays. An accurate survey of flash spotting posts and sound ranging microphones is essential for good results by either method of observation.

Major Farrow closed his address with an extremely interesting account of the work carried out during "Operation Ventable", which was the combined Canadian and British operation which broke through the Siegfried Line in February, 1945.

A. S. G. Musgrave acted as chairman for the evening and conveyed the thanks of the meeting to the speaker for his interesting address.

WINNIPEG BRANCH

R. T. Harland, M.E.I.C. - - *Secretary-Treasurer*

Electrical Section

L. A. Bateman - - - - - - - - *Secretary*
D. C. Bryden - - - - - - - *News Editor*

The regular April meeting of the Electrical Section of the Winnipeg Branch was held in Theatre F, University of Manitoba on April 3. D. A. McCuaig, the newly-elected chairman, presided.

The paper **The Maintenance of Power Transformers** was presented by T. E. Storey, general superintendent of production, Winnipeg Hydro Electric System. Mr. Storey discussed his subject under four general headings: tank and fittings, bushings, core and coils, and oil. Methods of tank maintenance for the prevention of rust and exclusion of moisture were outlined generally, with particular reference to the prevention of rust and breathing in relief pipes. The detection of moisture and deterioration in bushings and transformer windings by the power factor method was discussed in some detail and illustrated by test results of transformer windings before and after drying. The use of the low voltage capacitance bridge as a testing tool in measuring power factor was indicated. The various tests that can be applied to insulating oil were described and the equipment used for making these tests shown. These include dielectric, color and acidity, and power factor. The value of interfacial tension tests on oil was also noted.

The various phases of maintenance and testing of transformers provoked considerable discussion, and a vote of thanks was proposed by L. M. Hovey, Winnipeg Electric Company.

Library Notes

Book notes, Additions to the Library of The Engineering Institute, Reviews of New Books and Publications

BOOK REVIEW

ELECTRONIC ENGINEERING MASTER INDEX

Edited by Frank A. Petraglia. New York, Toronto, Macmillan, 1946. 209 p. 10¼ x 7 in., fabrikoid, $6.00.

Reviewed by Josephine Sheffield*

As indicated in the preface, this is a special edition of the complete and unabridged contents of Part II of the Electronic Engineering Master Index, which was published in 1945 by Electronic Research Publishing Company, New York City. Part II indexes sixty-five periodicals for the 1935-1945 period. A certain number of these periodicals are completely indexed; the remainder are indexed only for articles dealing with electronic subjects. Of approximately 10,000 entries, 7,000 listings belong to the former group, and over 3,000 to the latter.

Each entry gives the title of the article, the author, periodical, volume, page, and date of issue. The articles are grouped and cross-indexed under topical headings, alphabetically arranged. The subject headings chosen are in line with the terminology familiar to engineers and technologists in this field and the cross-indexing is adequate. "See also" references are used sparingly. To facilitate searches a "cross-index of subjects" is included at the back of the book. This lists all subject headings used as well as "see" references.

This bibliography will be particularly useful to new libraries in the electronic field or to individual engineers. For well-established libraries, with back files of other available indexes, its usefulness will be limited. In no case could it be considered an exhaustive list of references on any one subject, even for the period covered; two leading English magazines (Electronic Engineering and Wireless World) and some American periodicals (Radio, Electronic Industries (now Tele-Tech) and FM Magazine) are unfortunate omissions. The lack of author and title entries does not limit its usefulness.

Its chief value is for speedy reference, as the starting point for a more exhaustive search, and as a quick, handy, bibliography of electronic subjects.

Librarian, Electronics Division, Engineering Dept., Northern Electric Company, Limited, Montreal, Canada.

ADDITIONS TO THE LIBRARY

TECHNICAL BOOKS, ETC.

Canada. Eighth Census, 1941:
Volume 7—Gainfully Occupied by Occupations, Industries, etc. Ottawa, King's Printer, 1946. 1138 pp., illus., fabrikoid.

Explaining the Atom:
Selig Hecht. N.Y., Viking, 1947. 205 pp., illus., cloth.

Ferrous Metallurgical Design; Design Principles for Fully Hardened Steel:
J. H. Hollomon and L. D. Jaffe. N.Y., Wiley; London, Chapman and Hall, (c1947). 346 pp., illus., cloth.

German Research in World War II; an Analysis of the Conduct of Research:
L. E. Simon. N.Y., Wiley; London, Chapman & Hall, (c1947). 218 pp., illus., cloth.

Heating, Ventilating, Air Conditioning, Guide, 1947 Volume 25:
N.Y., American Society of Heating and Ventilating Engineers (c1947). 1282 pp., illus., fabrikoid.

Introduction to Engineering Plastics:
D. W. Brown and W. T. Harris. N.Y., Toronto, Murray Hill (c1947). 274 pp., illus., cloth.

Tungsten; Its History, Geology, Ore-Dressing, Metallurgy, Chemistry, Analysis, Applications and Economics 2nd ed., rev. and enlarged:
K. C. Li and C. Y. Wang. N.Y., Reinhold, 1947. 430 pp., illus., cloth. (A.C.S. Monograph No. 94).

PROCEEDINGS, TRANSACTIONS, ETC.

Institution of Electrical Engineers:

Journal, Volume 93, Part IIIa, No. 5, 1946. Proceedings at the Radio-location Convention, March-May, 1946.

Kungl. Teknisks Hogskolans. Handlingar. (Royal Institute of Technology, Stockholm, Sweden, Transactions):

Nr 6, 1947—Some Units in the Giorgi System and the C. G. S. System, Erik Hallen.

...Nr 7, 1947—A Peculiar Thermodynamical Analogy, Matts Backstrom.

Nova Scotia Institute of Science, Halifax, N.S.:

Proceedings, Volume 21, Parts 3 & 4, 1944-1946.

Society for the Promotion of Engineering Education:

Proceedings, Volume 53, 1945-1946.

TECHNICAL BULLETINS, ETC.

Bell Telephone System. Technical Publications. Monographs:

B-1362—Determination of Carbon in Low-Carbon Iron and Steel, L. A. Wooten and W. G. Guldner.—B-1366—Composition and Dielectric Properties of Ceramic Materials, M. D. Rigterink, R. O. Grisdale, and others.—B-1370—Solution of Linear and Slightly Nonlinear Differential Equations, S. A. Schelkunoff.—B-1371—Principal and Complementary Waves in Antennas, S. E. Schelkunoff.—B-1372—Concerning Hallen's Integral Equation for Cylindrical Antennas, S. A. Schelkunoff.—B-1373—Thermal Neutron Scattering Studies in Metals, F. C. Nix and G. F. Clement.—B-1374—Effect of Small Stresses on Magnetic Properties, R. M. Bozorth and H. J. Williams.—B-1375—Demountable Soundproof Rooms, W. S. Gorton.—B-1376—A Simple Refractoscope for Liquids, G. W. Willard.—B-1377—A Simple Optical Method for the Synthesis and Evaluation of Television Images, R. E. Graham and F. W. Reynolds.—B-1378—A New Crystal Channel Filter for Broad Band Carrier Systems, E. S. Willis.—B-1379—A Wide Angle 35mm High-Speed Motion Picture Camera, J. H. Waddell.—B-1380—Electron Ballistics in High-Frequency Fields, A. L. Samuel.—B-1381—Note on a Simple Transmission Formula, G. T. Friis.—B-1382—Applications of Thin Permalloy Tape in Wide-Band Telephone and Pulse Transformers, A. G. Ganz.—B-1383—Propagation of 6-Millimeter Waves, G. E. Mueller.—B-1384—The Effect of Rain Upon the Propagation of Waves in the 1- and 3-Centimeter Regions, S. D. Robertson and A. P. King.—B-1385—Radar Systems Considerations, D. A. Quarles.—B-1386—A new Magnetomotive Force Gauge and Magnetic Field Indicator, W. B. Ellwood.—B-1387—The Elastic, Piezo-electric and Dielectric Constants of Potassium Dihydrogen Phosphate and Ammonium Dihydrogen Phosphate, W. P. Mason.—B-1388—Weathering of Soft Vulcanized Rubber, J. Crabtree and A. R. Kemp.—B-1389—The Effect of High Humidity and Fungi on the Insulation Resistance of Plastics, J. Leutritz, Jr. and D. B. Herrmann.—B-1390—A Small Acoustical Tube for Measuring Absorption of Acoustical Materials in Auditoriums, D. P. Loye and R. L. Morgan.—B-1391—Sonar for Submarines, C. R. Sawyer and R. S. Lanier.—B-1392—Paper Capacitors Containing Chlorinated Impregnants, L. Egerton and D. A. McLean.—B-1393—Comparison of Natural and Synthetic Hard Rubbers, G. G. Winspear, D. B. Herrmann, and others.—B-1394—Wood Soil Contact Culture Technique for Laboratory Study of Wood-Destroying Fungi, Wood Decay and Wood Preservation, J. Leutritz, Jr.—B-1395—X-Ray Studies of Surface Layers of Crystals, E. J. Armstrong.—B-1396—Lightning Protection of Buried Toll Cables, E. D. Sunde.—B-1397—Pitch, Loudness and Quality of Musical Tones, Harvey Fletcher.—B-1398—Signal and Noise Levels in Magnetic Tape Recording, D. E. Wooldridge.—B-1399—Optimum Air Gap for Various Magnetic Materials in Cores of Coils Subject to Superposed Direct Current, V. E. Legg.—B-1400—Physical Limitations in Electron Ballistics, J. R. Pierce.—B-1402—Thermal Evidence of Crystallinity in Linear Polymers, W. O. Baker and C. S. Fuller.—B-1403—Nonlinearity in Frequency-Modulation Radio Systems due to Multipath Propagation, S. T. Meyers.—B-1404—High Current Electron Guns, L. M. Field.—B-1405—Some Recent Contributions to Synthetic Rubber Research, C. S. Fuller.—B-1406—Performance Characteristics of Various Carrier Telegraph Methods, T. A. Jones and K. W. Pfleger.—B-1412—Linear Servo Theory, R. E. Graham.—B-1414—A Study of the Delays Encountered by Toll Operators in Obtaining an Idle Trunk, S. C. Rappleye.

British Rubber Development Board:

The Compounding, Pigmenting and Thickening of "Positex"; (With some Notes on the Removal of Rubber from Fibrous Materials) by C. M. Blow. London, the Board, 1947. (Positex Pamphlet No. 2).

Canada. Dominion Bureau of Statistics. Education Statistics Branch:

Canadian Census Occupational Data for Counsellors. (Educational Bulletin No. 1, 1947).

Central Board of Irrigation; India. Popular Series Leaflets:

...No. 1—Irrigation in India.
...No. 2—Irrigation Research in India.
...No. 3—New Projects for Irrigation and Power, 1947.

Edison Electric Institute and Bell Telephone System:

Mutual Assistance in General Emergency Situations Affecting both Power and Telephone Service; a Report of—Joint Subcommittee on Co-operation in Emergencies E.E.I. and B.T.S.

Electrochemical Society. Preprints:

91-15—Aluminum from a Fused Chloride Bath, Colin G. Fink and Dushyant N. Solanki—91-16—Recent Developments on the Preparation of Zirconium, W. C. Lilliendahl and H. C. Rentschler—91-17—Corrosion and Oxidation Experiences in High Pressure and High Temperature Steam Service, Paul M. Brister and J. B. Romer—91-18—Specially Processed Silicon Carbide as a Deoxidizing Agent in the Reducing Slag of Basic Electric Steelmaking, E. A. Loria and H. D. Shephard, and others—91-19—Electro-deposited Silver on Steel for Glas-to-Metal Seals, Norman S. Freedman—91-20—Minimum Sparking Potentials of Barium. Magnesium and Aluminum in Helium, Harold Jacobs and Armand P. LaRocque—91-21—Zirconium and Thorium Electrodes in Discharge Lamps, H. C. Rentschler, D. E. Henry and others—91-22—The Reaction of Sulfur Dioxide, Water and Oxygen in an Electrolytic Cell, W. F. Seyer, T. C. Assaly, and others—91-23—High Temperature Corrosion of Metals Under Alternate Carburization and Oxidation, Harry K. Ihrig.—91-24—The Oxidation of Metals, W. E. Campbell and U. B. Thomas.

Illinois. University. Engineering Experiment Station:

Bulletin Series: *No. 364—Steam Turbine Blade Deposits . . . by Frederick G. Straub.—No. 366—Performance of an Indirect Storage Type of Hot-Water Heater . . . by Alonzo P. Kratz and Warren S. Harris.—No. 367—Influence Charts for Computation of Vertical Displacements in Elastic Foundations by Nathan M. Newmark.*

...Reprint Series: *No. 34—Progress Report of the Joint Investigation of Methods of Roadbed Stabilization . . . Ralph B. Peck.—No. 35—Progress Reports of Investigation of Railroad rails and Joint Bars.—No. 36—Electro-Organic Chemical Preparations, Part III by Sherlock Swann, Jr.*

National Research Council. Information for the Press. Release:

No. 7—Radar Aid at Harbour Entrance.

North-East Coast Institution of Engineers and Shipbuilders. Advance Papers:

Experiments in the Lithgow Propeller Tunnel, A. Emerson and L. W. Berry (Communication from the National Physical Laboratory).

...Some Model and Full Scale Experiments on Side Launching, F. H. Todd and E. Laws.

Princeton University. Industrial Relatious Section:

Employee Rating. (Selected References, No. 15, 1947).

Quebec (Prov.). Dept. of Mines. Bureau of Geological Surveys:

Castagnier Map-Area, Abitibi-East County, by W. Warren Longley. (Geol. Report 26).

Union of South Africa. Department of Forestry:

The Preparation and Preservative Treatment of Poles. -Bulletin No. 30).

STANDARDS, SPECIFICATIONS, ETC.

American Standards Association. Standards:

...ASA Z32.12-1947—American Standard Basic Graphical Symbols for Electric Apparatus.
...ASA Z32.13-1946—American Standard Abbreviations for use on Drawings.
...American Safety Standards. (PM 87).

American Welding Society. Specifications:

Standard Specifications for Welded Highway and Railway Bridges; Design, Construction and Repair. 4th ed. (D2.0-47).
...Tentative Specifications for Corrosion Resisting Chromium and Chromium-Nickel Steel Welding Electrodes. (A5.4-46T).

British Standards Institution. Standards:

BS 1368-1947—Dimensions of Ignition and Lighting Units for Motor Cycles. BS 5027-1947—Dimensions of Unscreened Magnetos.

U.S. National Bureau of Standards. Building Materials and Structures:

Report BMS 108—Temperature Distribution in a Test Bungalow with Various Heating Devices by Richard S. Dill and Paul R. Achenbach.

PAMPHLETS, ETC.

Application of L-P Gas Plants to the Gas Utility Problem:

Warren C. Meyer. (Presented at the Convention of Gas Meters Association of Florida-Georgia, April 26, 1947).

British Columbia Snow Surveys for Columbia Basin in B.C. Including Okanagan and Lower Coastal Areas:

Report by V. L. Mosher. Victoria, B.C., Dept. of Lands and Forests, Water Rights Branch, 1947.

Can the Serviceman Serve the "Ham"?:

John F. Rider. N.Y., John F. Rider Publisher, Inc., 1947.

Cubicles and Control Desks:

F. T. Bennell. Manchester, Emmott & Co., Ltd., (1946). (Mechanical World Monographs 36).

Dielectric Heating in the Furniture Industry:

D. G. Miller. (Reprinted from Canadian Woodworker).

Economic Survey for 1947:

Presented by the Prime Minister to Parliament by command of His Majesty Feb. 1947. London, H. M. Stationery Off., 1947 (Cmd. 7046).

Engineering Aspects of the Involute Spline:

N.Y., Broaching Tool Institute, 1947. (Reprinted from the Iron Age, April 3, 1947).

The Explosives Act; 1946:

10 George VI, Chapt. 7, Explosives Act, 1946 and Regulations. Ottawa, Bureau of Mines, Explosives Division, 1947.

Highway Plan for Shreveport, Louisiana:

Prepared for the State of Louisiana, Department of Highways . . . by H. W. Lochner & Co. Chicago, H. W. Lochner & Co., 1947.

Infra-Red Heating:

A. E. Williams. Manchester, Emmott & Co., Ltd., (1947). (Mechanical World Monographs 37).

New Developments in Electrical Industrial Trucks:

B. I. Ulinski. Chicago, News Associates, 1947.

Synthesis of Amino Acids from Substituted Cyanoacetic Esters. 4-Alkyl-3-Aminopyrazolones:

Paul E. Gagnon, Kenneth Savard, and others. (Reprinted from Canadian Journal of Research, B, 25:28-36. Jan. 1947, published by the National Research Council of Canada).

Vannevar Bush: Ninth Hoover Medallist:

N.Y., Hoover Medal Board of Award, 1946.

World at the Crossroads:

Anita Blaine, Edwin H. Cassels, and others (the Executive Committee of the World Citizens Association). Chicago, the Association, 1946.

Zoning Applied to Parking:

Charles S. LeCraw, Jr. and Wilbur S. Smith. Saugatuck, Conn., Eno Foundation for Highway Traffic Control, 1947.

BOOK NOTES

The Institute does not assume responsibility for any statements made; these are taken from the preface or the text of the book.

The following notes on new books appear here through the courtesy of the Engineering Societies Library of New York, and may be consulted at the Institute Library.

APPLIED ENGINEERING MECHANICS:

A. Jensen. McGraw-Hill Book Co., New York and London, Toronto, Embassy, 1947. 316 pp., diagrs., tables, 9¼ x 6 in., cloth, $3.00.

This book is intended to provide a text that meets the minimum requirements of the usual college course but needs only an understanding of high-school mathematics. Mathematical manipulations have been replaced in large part by basic scientific reasoning from the physical concepts. The book is divided into the customary two sections, statics and dynamics, with a logical gradation from the elementary to the more involved concepts in each case. Analytical and graphical solutions are presented side by side to show relationship and encourage the student to check one against the other.

CONCISE CHEMICAL and TECHNICAL DICTIONARY:

Edited by H. Bennett. Chemical Publishing Company, Brooklyn, N.Y.; General Publishing Co., Toronto, 1947. 1055 pp., diagrs 9¼ x 6 in., cloth, $14.00 (in Canada).

Some 50,000 definitions are included in this volume which covers the whole field of scientific and technical development, including common and rare chemicals, raw materials and finished products, processes and machinery, engineering terms, etc. Basic data are given for chemical compounds. A feature of the book is the inclusion of a large number of trade-name or proprietary products giving chemical composition, properties, and major applications. The appendix contains diagrammatic representations of important organic ring systems. The chemical field is emphasized.

CONTROL CHARTS in FACTORY MANAGEMENT:

W. B. Rice. John Wiley & Sons, New York; Chapman & Hall, London, 1947. 149 pp., diagrs., charts, tables, 9¼ x 5¾ in. cloth, $3.00 (in Canada).

The underlying theory of statistical control is first discussed, followed by practical information concerning its proper and effective use. Its basic functions in manufacturing plants are demonstrated, particularly by the use of case histories which show how causes of bad work can be eliminated and business efficiency increased through the study and analysis of factory processes. Intended particularly for the business or factory executive, the book should be of equal value to those who have the direct responsibility of such work.

ELEMENTS OF MECHANISM:

P. Schwamb, A. L. Merrill and W. H. James. 6 ed., revised by V. L. Doughtie. John Wiley & Sons, New York; Chapman & Hall, London, 1947. 428 pp., illus., diagrs., charts, tables, 9½ x 5¾ in., cloth, $4.00.

This standard textbook gives the fundamental principles of kinematics in the field of mechanical movements. Principal machine elements are selected, and a study is presented of their motions when combined in certain ways. The early chapters cover motion in general, vectors, velocity and acceleration analysis, and linkages. Cams, gears, belts, etc., are discussed in detail in the later chapters. This new edition includes for the first time a group of laboratory problems emphasizing practical applications.

ENGINEERING PROBLEMS MANUAL:

F. C. Dana and L. R. Hillyard. 4th ed. McGraw-Hill Book Co. New York and London, Embassy, Toronto 1947. 419 pp., illus. diagrs., charts, tables, 9¼ x 6 in., cloth, $3.25.

As in previous editions of this book, the purpose has been to offer a student manual for the engineering problems course. The material is based upon practical engineering situations and aims to coordinate the work in algebra, trigonometry and calculus, and to develop good habits of work and study toward the attainment of a high degree of clearness and accuracy in calculation. The problems have been selected from a wide variety of applications and many new ones have been added in the present edition. The book has undergone considerable general revision.

HEATING, VENTILATING, AIR CONDITIONING GUIDE. 1947, Vol. 25:

Tehnical Data Section and Manufacturers' Catalog Data Section, also Roll of Membership of the Society, with Complete Indexes.

American Society of Heating and Ventilating Engineers, 51 Madison Ave., New York. 1282 pp. plus 128 pp., illus., diagrs., charts, tables, 9¼ x 6 in., fabrikoid, $6.00.

This standard manual constitutes both a textbook and handbook on the design and specification of heating, ventilating, and air conditoning systems. The technical section has been thoroughly revised, and new material has been added, particularly in the chapters on heating and cooling loads. There is also a new section describing the air refrigeration cycle. It provides all the data ordinarily needed by engineers and architects, cross indexed for quick reference. The catalog section contains information on the products of over two hundred manufacturers, with a classified index. (Continued on page 308)

PRELIMINARY NOTICE

of Applications for Admission and for Transfer

May 30th, 1947

The By-laws provide that the Council of the Institute shall approve, classify and elect candidates to membership and transfer from one grade of membership to a higher.

It is also provided that there shall be issued to all corporate members a list of the new applicants for admission and for transfer, containing a concise statement of the record of each applicant and the names of his references.

In order that the Council may determine justly the eligibility of each candidate, every member is asked to read carefully the list submitted herewith and to report promptly to the Secretary any facts which may affect the classification and selection of any of the candidates. In cases where the professional career of an applicant is known to any member, such member is specially invited to make a definite recommendation as to the proper classification of the candidate.*

If to your knowledge facts exist which are derogatory to the personal reputation of any applicant, they should be promptly communicated.

Communications relating to applicants are considered by the Council as strictly confidential.

The Council will consider the applications herein described at the July meeting.

L. Austin Wright, General Secretary

*The professional requirements are as follows:—

A **Member** shall have been engaged in some branch of engineering for at least six years, which period may include apprenticeship or pupilage in a qualified engineer's office or a term of instruction in a school of engineering recognized by the council. In every case a candidate for election shall have held a position of professionl responsibility for at least two years. The occupancy of a chair as professor, assistant professor, associate professor or lecturer in a faculty of applied science or engineering, shall be considered as professional responsibility.

Every candidate who has not graduated from a school of engineering recognized by the council shall be required to pass an examination as prescribed by council, on the theory and practice of engineering, with special reference to the branch of engineering in which he has been engaged.

A **Junior** shall have been engaged in some branch of engineering for at least four years. This period may be reduced to one year, if the candidate for election has graduated from a school of engineering recognized by the council, in which case he shall not remain in the class of Junior beyond the end of the eighth year after graduation.

Every candidate who has not passed the examinations of the third year in a school of engineering recognized by council shall be required to pass an examination in engineering science as prescribed by council. He shall not remain in the class of Junior beyond age thirty.

A Junior may be transferred to Member without payment of transfer fee providing he makes application before the end of the seventh year after graduation or, if a non-graduate, before attaining age twenty-nine, and his application is approved by council.

Council may extend the above limits if in its opinion special circumstances warrant such extension.

A **Student** shall be at least seventeen years of age, and shall present a certificate of having passed an examination equivalent to the final examination of a high school, or the matriculation of an arts or science course in a school of engineering recognized by the council or shall be required to write examinations as prescribed by the council.

He shall be:

a. pursuing a course of instruction in a school of engineering recognized by the council, in which case he shall be transferred to Junior automatically without payment of transfer fee in the second January after graduation, or

b. receiving a practical training in the profession in which case he shall be transferred to Junior without payment of transfer fee providing he makes application before attaining age twenty-five and his application is approved by council.

He shall not remain in the class of Student after he has attained the age of twenty-five, unless in the opinion of council special circumstances warrant the extension of this age limit.

An **Affiliate** shall be one who is not an engineer by profession but whose pursuits, scientific attainments or practical experience qualify him to co-operate with engineers in the advancement of professional knowledge.

The fact that candidates give the names of certain members as reference does not necessarily mean that their applications are endorsed by such members.

FOR ADMISSION

BEECHING—THOMAS ARTHUR GEORGE, of Montreal, Que. Born at Great Yarmouth, Eng., Oct. 10, 1913. Educ.: B.A.Sc. (Elect.), British Columbia, 1939; 1938 (summer), bond testing, street car tracks, B.C. Electric; 1940-44, Air Force Inspecn. Canada (3 mos.), inspecn. school in Toronto, then posted No. 13 Tech. Detach., Vancouver, work in connection with bldg. Catalina Amp. Flying Boats at Boeing Aircraft, covered all phases constrn. of plane incl. industrial processes, tooling; 1944-46, asst. to elect. supt., on constrn. 5-10,000 ton mtce. ships for Royal Navy, work consisted principally of laying out circuits, ordering equipt., layout of elect. circuits for several cargo vessels, tugboats, converted Naval vessels (for Union S.S. Co.), West Coast Shipbuilding Co., Vancouver, B.C.; 1946 (4 mos.), went to Sweden, visited most of principal heavy industries and modern generating plants with view to broadening experience; at present, sales engr., Brown, Boveri (Canada) Ltd., Montreal, Que.

References: F. C. Green, J. N. Finlayson, H. J. MacLeod, A. Leuthold, C. Meier.

BOEHM—CARL RICE, Colonel, R.C.E.M.E., of Toronto, Ont. Born at Toronto, Ont., July 9, 1905. Educ.: B.A.Sc., Toronto, 1929; R.P.E., Ontario; 1925-29 (summers), eng. student, International Nickel; eng. student, mill operator, Hollinger Cons. Gold Mines; asst. engr., Paymaster Gold Mines; 1929 (4 mos.), mine engr., Howey Gold Mines Ltd.; 1929-32, asst. surveyor, asst. ventilation engr., Frood Mine (Int. Nickel); 1932-37, asst. mine engr., chief mine engr., shift boss, Falconbridge Nickel Mines; 1937-38, mine mgr., Denison Nickel Mines Ltd.; 1939, shaft supt., Powell Rouyn Gold Mines, mine mgr., Denison Nickel Mines; 1939-44, Ordnance Mech. Engr., R.C.O.C.; with R.C.E.M.E., as follows: 1946-47, Director, Mech. Engrg., and at present, Deputy Director, Mech. Engrg., Army H.Q., Directorate of Mech. Engrg., Ottawa, Ont. Member C.I.M.M.

References: J. W. Bishop, G. R. Turner, H. E. T. Haultain, G. Thompson, L. A. Wright.

BROWN—ARCHIBALD MAXWELL, of Toronto, Ont. Born at Polemont, Scotland, Nov. 8, 1904. Educ.: National Diploma (Mech. and Elect.), 1926, while at Rutherford Tech. Coll.; R.P.E., Ontario (by exam.); with C. A. Parsons & Co., Ltd., Newcastle-on-Tyne, 1924, apprent., 1926, pattern, gear, genl. erection, transformer, shops, alternator and transformer test shop, etc., 1926-28, alternator, steam turbine, condenser, gearing, blower, compressor, transformer, design depts., 1928, loaned to F. John Bell, M.E.I.C. (Canadian representative C. A. Parsons & Co., Ltd.), sales engrg., preparation specifications, handling and completing contracts, preliminary layouts and tenders covering steam turbo alternator units, surface condensers, etc., 1945, chief engr. and director, and at present, general mgr. and director, C. A. Parsons of Canada, Limited, Toronto, Ont.

References: J. T. Farmer, J. H. McLaren, J. B. Hayes, J. G. Hall, F. J. Bell, F. E. Regan, A. E. Allcut, E. A. Goodwin, H. A. Cooch, G. A. Gaherty, J. G. MacGregor, B. M. Hill, E. V. Buchanan.

DRUMMOND—ROBERT, of Toronto, Ont. Born at Glasgow, Scotland, Nov. 21, 1903. Educ.: Matric. (McGill requirements), structl. engrg. by tutor and corr. schools; with Anglin-Norcross Ltd., as follows: 1920-24, apprent. estimating and surveying, 1924-29, estimating, designing, field work, genl. bldg. constrn., 1929-37, suprvn. and management, genl. bldg. constrn.; 1937 to date, managing-dir., suprvn. and management, genl. constrn., A. W. Robertson, Ltd., Toronto, Ont.; Director, Rayner Construction Ltd., Angus Robertson Ltd., Ontario Ready Mix Concrete Ltd. and Ready Mixed Concrete Ltd., Toronto, Ont. (For admission as Affiliate.)

References: E. S. Miles, N. A. Eager, C. D. Carruthers, B. deHueck, J. B. Stirling, C. S. Kane, D. Shepherd, D. G. Anglin.

HICKS—RICHARD WILLIAM, of Winnipeg, Man. Born at Williamsport, Pa., Feb. 25, 1910. Educ.: B.Sc. (Elect. Engrg.), Manitoba, 1931; 1931-33, sales engrg., power plant equipt., W. W. Hicks & Co., Winnipeg, Man.; 1933-34, sales engrg., power plant equipt., Peacock Bros., Ltd., Montreal; 1934-42, personal asst. to manager of mfg., Canadian International Paper Co., Montreal; 1942-45, F/O, Navigator, R.C.A.F.; at present, sales engr. and jr. partner, W. W. Hicks & Co., Winnipeg, Man.

References: G. R. Fanset, D. Hunter, D.M. Stephens, I. S. Patterson, E. P. Fetherstonhaugh.

MATTHEWS—HAROLD, of Vancouver, B.C. Born at Liverpool, England, Jan. 4, 1906. Educ.: Mech. engrg. course, I.C.S.; R.P.E., British Columbia, (by exam.); 1922-27, mach. apprent., Empire Mfg. Co.; 1927-30, asst., engrg. dept., Vulcan Iron Works; with Vancouver Iron Works, Ltd., as follows: 1930-38, asst., engrg. dept.; 1938 to date, chief engr.

References: J. S. Wilson, W. T. Fraser, J. B. Parham, W. Rae, A. R. C. Yuill, W. N. Kelly.

POWRIE—ROBERT DAVID, of Montreal, Que. Born at Toronto, Ont., May 16, 1911. Educ.: B.Arch., Toronto, 1938; 1937-40, arch. dftsman, design, working drawings, checking of shop drawings for large group of hospital bldgs., Ontario Government, Brantford, Ont.; 1941-43, asst. project engr., responsible for all labs., cafeterias, staff hotels at company projects, layout specifications for bldgs., ordering of materials, checking of structl., elect., mech. and arch. drawings, Defence Industries Ltd.; 1943-44, officer, investigations of essentiality of applications for licences for constrn. operations and instln. of equipt., exam. of plans, etc., Dept. of Munitions and Supply; 1944-46, asst. project engr., responsible for all labs. and townsite bldgs. at Chalk River Project, responsible under direction for design, layout, coord. of structl., elect. and mech. drawings to provide facilities required, Defence Industries Limited; at present, arch. dftsman., preparation of working drawings for bldgs., largely of an engrg. nature, Canadian Pacific Railway, Montreal, Que.

References: R. H. C. Hodgson, R. B. Jones, L. H. Lafolley, J. G. Sutherland A. W. Bridgewater, C. H. Jackson.

POYSER—LINDSAY EARL, of Austin, Man. Born at Austin, Man., Feb. 20, 1922. Educ.: B.Sc. (Elect.), Manitoba, 1944; 1944-46, Lieut. R.C.E.M.E., Workshop Officer; 1 yr. course, E.M.E.; 1946 to date, lab. demonstrator, University of Manitoba, Winnipeg, Man.

References: E. R. Love, A. E. Macdonald, G. H. Herriot, E. P. Fetherstonhaugh, N. M. Hall.

SOUTHAM—WILLIAM WATSON, of Montreal. Born at Hamilton, Ont., April 16, 1908. Educ.: B.Sc. (Elect. Engrg.), McGill, 1930; 1927-28-29 (summers), C.N.R. Survey; H.E.P.C. of Ontario; 1938-45, prod. mgr., Vancouver Daily Province, Vancouver, responsible for operation and mtce. of mech. publishing plant (for 2 mos. in 1938 and 10 mos. in 1941-42, was responsible for instln. of printing machinery aggregating half million dollars); at present, executive asst. (prod.), tech. adviser to president of company in connection with eight printing and publishing plants, The Southam Co., Limited, Montreal, Que.

References: C. E. Parish, F. I. Ker, L. B. Stacey, D. E. Ellis.

TREGASKES—NORMAN ERNEST, of Toronto, Ont. Born at Toronto, Ont., Jan. 4, 1912. Educ.: B.A.Sc., Toronto, 1934; R.P.E., Ontario; with Dept. Highways, Ontario, as follows: 1934-36, instru'man. on highway constrn. and location, 1936-37, res. engr., Peterboro, i/c constrn., 1937-42, res. engr., i/c dual highway constrn. east and west of Toronto (Queen Elizabeth Way); 1942-43, asst. engr., hydraulic dept., H.E.P.C. of Ontario; 1943-45, Lieut., R.C.E.; at present, asst. engr., asst. to section head, leases and agreements section, hydraulic dept., H.E.P.C., Toronto, Ont.

References: F. W. Clark, S. W. B. Black, J. R. Montague, J. J. Traill, O. Holden.

TURNER—JOHN HARRIS, Montreal, Que. Born at Saskatoon, Sask., Sept. 2, 1918. Educ.: B.A.Sc. (Metall.), Toronto, 1946; 1946, development and engrg. dept., Canadian Liquid Air.

References: F. G. Kerry, C. G. Williams, W. S. Wilson, H. H. Minshall, C. J. Mackenzie.

TURNEY—ARTHUR JAMES, of Hamilton, Ont. Born at Oxford, England, June 10, 1913. Educ.: 1943-45, McMaster Univ., Physics and Chemistry (night school ext.); 1932, apprent., Gough Engineering Co., Ltd.; 1933-34, Dominion Foundry & Steel Co.; 1935-38, design and supvr. constrn., Sauble Beach Golf Course; with Steel Co. of Canada, Ltd., Hamilton, as follows: 1938-43, dftsman., then chief dftsman, i/c dfting. office, plant layout and machine design, 1943-45, mech. engr., i/c dfting. and engrg. office, responsible for design and instln. of equipt., material handling, estimates, appropriation detail, bldg. survey, etc., 1945 to date, asst. mech. supt., directly responsible for mtce. of bldgs., machinery and equipt., operation and suprvn. of machine shop, tool room, engrg. and dfting. office, experimental dept. and development work, responsible for tools and dies, instln. of new equipt., plant layout.

References: S. C. Anderson, J. C. Callaghan, A. E. Tuck, W. H. Collins, W. L. McFaul, E. D. W. Courtice, W. E. Brown.

WADDINGTON—JOHN STANLEY, of Brockville, Ont. Born at Winnipeg, Man., July 1, 1913. Educ.: B.Sc. (Elect. Engrg.), Manitoba, 1934; R.P.E., Ontario; 1936, inspector, Canadian Marconi Co., Mt. Royal; with Phillips Electrical Works, as follows: 1936-38, jr. engr., product and process development, 1938-43, engrg. asst., special studies for president of company; 1944-46, elect. engr., wire and cable design, and at present chief engr., Brockville, Ont.

References: T. W. Brackinreid, T. A. Lindsay, H. W. Lee, D. A. S. Laing, A. Sandilands.

WHELAN—HENRY JOSEPH, of Toronto, Ont. Born at Vancouver, B.C., Jan. 20, 1922. Educ.: B.Sc. (Mech. Engrg.), Saskatchewan, 1945; 1941-44 (summers), surveyor and dftsman., Sask. Dept. Highways; P.F.R.A.; Public Roads Admin.; engr.'s asst., Imperial Oil, Regina; with British American Oil Co., Ltd., Toronto, as follows: 1945, engr. dftsman., 1945 to date, mech. engr., project and industrial, Toronto, Ont.

References: N. B. Hutcheon, I. M. Fraser, I. S. Widdifield, R. H. Self, E. C. Hurd.

LIBRARY NOTES (*Continued from page 306*)

HYDRAULIC MEASUREMENTS:

H. Addison. 2 ed. rev. & enl. John Wiley & Sons, New York, 1946, 327 pp., illus., diagrs., charts, tables, 8¾ x 5½ in., cloth, $5.00.

This manual for engineers is an amplification of the last chapter of the author's "Textbook of Applied Hydraulics". Wholly practical in treatment, the book covers the measurement of both open channel flow and flow in pipes and conduits. It deals with liquids only, omitting any discussion of gas metering. The final chapter covers indicating, recording and integrating instruments. There is a bibliography.

INTRODUCTION TO ENGINEERING PLASTICS:

D. W. Brown and W. T. Harris. Murray Hill Books, Inc., Technical Division, New York and Toronto, 1947, 274 pp., illus., diagrs., charts, tables, 9¼ x 6 in., cloth, $4.00.

A detailed account is given of the various plastics that have found commercial acceptance. Chapters are included on the engineering properties and the chemical and physical characteristics of plastics; applications and techniques in handling plastics; and a list of the types of plastics with trade names and manufacturers. The authors have also furnished plant and equipment data, design considerations, and commercial tolerances.

METAL WORKING AND HEAT-TREATMENT MANUAL, Vol. 2. Alloy Steels, Cast Iron and Non-Ferrous Metals:

F. Johnson, Paul Elek Publishers, Ltd., London, E.C.1., England 1947. 226 pp., illus., diagrs., charts, tables, 8¾ x 5½ in., cloth 17s.6d.

This is the second volume in a series of four to cover the entire range of heat-treatment of metals. Beginning with a brief resumé of steel-making processes, the book continues with detailed description of the important steel alloys and the characteristics imparted by various alloying elements and heat treatments. Two chapters are devoted to the composition and treatment of cast iron and the alloys of copper with zinc, tin and aluminium. Tables and diagrams are extensively used for the effective presentation of mechanical and metallurgical data. The final chapter deals with the phenomena of age-hardening in various alloys.

PRACTICAL DESIGNS for DRILLING, MILLING and TAPPING TOOLS:

C. W. Hinman. 2 ed. McGraw-Hill Book Co., New York and London; Embassy, Toronto 1946. 416 pp., illus., diagrs., tables, 9 x 5¾ in., cloth, $5.00.

This practical manual demonstrates the best methods for designing, drafting, and using drilling jigs, gages, hand tools, and tapping and milling fixtures. It illustrates the fundamental principles by which all tools must be designed for successful operation. With a wealth of illustrative material, detailed operational functions of tools, mathematical formulas, tool engineering tables, etc., it supplies the essentials for beginners and suggests new ideas for the experienced man. A list of educational films in the field is included.

RADIO AMATEUR'S HANDBOOK, 24th edition, 1947:

American Radio Relay League, West Hartford 7, Conn., 468 pp., illus., diagrs., charts, tables, 9½ x 6½ in., paper, $1.25 in U.S., elsewhere $2.00.

The three main sections of this annual publication are as follows: "Principles and Design" covers comprehensively the theory of radio communications and design of amateur transmitting, receiving, radiating and measuring apparatus; "Equipment Construction" starts with a brief chapter on workshop practice and continues with detailed instructions for the building of various types of receivers and transmitters, v.h.f. apparatus, emergency and portable equipment; "General" contains extensive tables of vacuum-tube characteristics and miscellaneous data and a chapter on amateur radio operating. The whole volume has been thoroughly revised to conform with current practice. A catalog section of short-wave equipment is appended.

RUSSIAN-ENGLISH TECHNICAL AND CHEMICAL DICTIONARY:

L. I. Callaham. John Wiley & Sons, New York; Chapman & Hall, London, 1947. 794 pp., 8 x 5½ in., fabrikoid, $10.00.

Originally planned to cover the chemical and process industries this dictionary has been expanded to give comprehensive coverage of mineralogy, metallurgy, mining and geology, general engineering, machinery and mechanics, electrical engineering, pharmacy and botany. Frequently used terms are also included for aeronautics, agriculture, medicine, physics, mathematics, and other scientific fields. A general vocabulary is included in the same alphabet, together with a large number of prefixes and suffixes. American usage and spelling are followed rather than British in the English equivalents.

SEWERAGE AND SEWAGE TREATMENT:

H. E. Babbitt. 6th ed. John Wiley & Sons, New York; Chapman & Hall, London, 1947. 692 pp., illus., diagrs., charts, tables, 8¾ x 5½ in., cloth, $6.50.

In the new edition of this standard text stress has been laid more on problems of design, methods of treatment, and the operation of plants than on construction. Its comprehensive coverage of all phases of the subject has been widened by the addition of material on high-rate filters, contact aerators, and other changes in practice. The most extensive revision has been in the material on runoff determinations and the hydraulics of sewers. Some forty-five pages of problems and literature references are appended.

AN URGENT REQUEST

Would members who do not file the *Journal* kindly return their April 1947 copy to headquarters.

Due to difficulties at the printers, fewer copies have been printed than had been ordered and the needs of several libraries have not been filled.

Employment Service

The service is operated for the benefit of members of The Engineering Institute of Canada, and for industrial and other organizations employing technically trained men—without charge to either party. It would therefore be particularly appreciated if employers would make the fullest possible use of these facilities to make known their existing or estimated requirements. Notices appearing in the Situations Wanted column will be discontinued after three insertions, and will be re-inserted upon request after a lapse of one month. Personal interviews by appointment.

Situations Vacant

CHEMICAL

CHEMICAL ENGINEER to be assigned to mill process problems for the technical department of a pulp and paper firm in the St. Maurice Valley. Salary $250. up. Apply to File No. 3573-V.

CHEMIST OR CHEMICAL ENGINEER required for work on fuel combustion by a Canadian firm producing aircraft gas turbines. Salary open. Apply to File No. 3836-V.

CHEMICAL ENGINEER, recent graduate up, required by a firm in Ottawa for plant and research work. Salary $200 up. Apply to File No. 3849-V.

CIVIL

CIVIL ENGINEER, recent graduate up, required by a pulp and paper company in the Province of Quebec, for work centered in logging operations and will consist principally of the construction of roads, bridges, dams and camps. Preferably bilingual. Salary from $225—$275. Apply to File No. 3850-V.

CIVIL ENGINEER with building construction experience required by a manufacturer in Montreal. Salary $250 up. Apply to File No. 3858-V.

CIVIL ENGINEER required by Town of Pointe Claire, bilingual, minimum five years experience in municipal work, capable of preparing tenders, specifications and drawings, water and sewer systems. Salary open. Apply to File No. 3863-V.

MECHANICAL

SENIOR MECHANICAL DESIGN ENGINEER required by a pulp and paper firm in the St. Maurice Valley to work directly under Chief Engineer on long range engineering projects. Salary $300 up. Apply to File No. 3573-V.

MECHANICAL ENGINEER required as assistant to vice-president and general manager of a medium sized company in Central Ontario. Experience in paper converting would be helpful. Prospects are excellent and salary open. Apply to File No. 3819-V.

MECHANICAL ENGINEER, recent graduate up, veteran preferred must be bilingual. Required to under study Manager and eventually take charge of four plants at St. John. Salary around $200 to start. Apply to File No. 3842-V.

MECHANICAL ENGINEER, recent graduate up, required by a company in Montreal for toll design. Salary $175 up. Apply to File No. 3843-V.

MECHANICAL ENGINEER experienced in mining plant construction, operation and maintenance, required by a mining company in Northwestern Quebec, at present constructing plant for relatively large scale operation. Salary $5,000 to $6,000. Apply to File No. 3845-V.

MECHANICAL ENGINEER recent graduate, preferably with some practical experience in manufacturing, required by a Farm Equipment manufacturer in Ontario. Starting salary $225. Apply to File No. 3851-V.

MECHANICAL ENGINEER, recent graduate, required by a paper mill in Northern Quebec. Salary $250. Apply to File No. 3852-V.

MECHANICAL ENGINEER, preferably with experience in heating and ventilating problems required in Montreal for design and investigation. Salary $250 up. Apply to File No. 3858-V.

METALLURGICAL

METALLURGIST, with at least 2 years foundry experience, required by a Montreal manufacturer to take charge of foundry practice and annealing. Salary open. Apply to File No. 3853-V.

MISCELLANEOUS

GRADUATE ENGINEERS, recent graduates up, preferably with pulp and paper experience, required by a pulp and paper firm in the St. Maurice Valley, to work under Chief Engineer and Senior Designer on long range modern projects. Salary $3,000 up. Apply to File No. 3573-V.

PROFESSOR in machine design, required for fall term by a university in Central Ontario. Salary open. Apply to File No. 3600-V (F).

CIVIL ENGINEERS AND ASSISTANT HYDRAULIC ENGINEERS required for government organization on West Coast for highway and construction. Salary open. Apply to File No. 3724-V.

GRADUATE ENGINEER with some aircraft engine experience required by a Canadian Firm to act as Liaison Engineer between engineering and production. Must have experience in Stress Analysis. Salary open. Apply to File No. 3836-V.

RESIDENT ENGINEER to take full charge of construction of $2,000,000. worth of buildings in Central Ontario. Salary around $5,000. Apply to File No. 3837-V.

CONSTRUCTION ENGINEER with carpenter foreman or supervisory experience required by an Engineering and Contracting firm in Montreal. Salary around $500. Apply to File No. 3838-V.

MECHANICAL, CHEMICAL AND ELECTRICAL ENGINEERS required by a firm of industrial consultants in Montreal. Salary from $400. Apply to File No. 3844-V.

GRADUATE ENGINEER, age 35-40, with 10 years experience in building construction and general contracting work; to supervise design, construction and maintenance of structures for Public Utility in Toronto. Permanent job. Salary open. Send photo and full particulars of education and experience. Apply to File No. 3847-V.

MAINTENANCE SUPERINTENDENT required by an industrial organization in Montreal to supervise the maintenance of wharves, buildings, conveyors, ships, loading and discharging equipment at Port Alfred docks. Salary $350 up. Apply to File No. 3848-V.

PLANT ENGINEER, preferably with paper mill experience required by a paper company in Quebec, to take charge of maintenance crews. Salary around $350. Apply to File No. 3854-V.

JUNIOR INDUSTRIAL ENGINEER, with mechanical or chemical background, preferably with knowledge of chemical plants, required in Montreal. Salary $250 up. Apply to File No. 3857-V.

RECENT GRADUATE required by a manufacturer in Ontario as assistant to Industrial Engineer duties include design and sales engineering of water and oil pumping equipment and water treatment equipment. Good chance for advancement. Salary open. Apply to File No. 3859-V.

DRAUGHTSMEN of the following classes: Architectural, piping layout, equipment layout, mechanical design, steam plant, heating, and ventilating, electrical and plumbing required by an industrial organization in Montreal. Salaries open. Apply to File No. 3860-V.

The following advertisements are reprinted from last month's Journal, having not yet been filled.

CHEMICAL

CHEMICAL ENGINEER OR CHEMIST, preferably with Ph.D., required by a pulp and paper company with plants in Eastern Canada, for research work. Salary open. Apply to File No. 3549-V.

CHEMICAL ENGINEER required by a pulp and paper company with plants in Eastern Canada, for mill control and pilot plant work. Salary open. Apply to File No. 3549-V.

CHEMICAL ENGINEER required by a petroleum refining company in Montreal for process and design work. Salary about $225. Apply to File No. 3575-V.

CHEMICAL ENGINEER required as assistant professor of chemical engineering in a Canadian university to start autumn 1947. Salary open. Apply to File No. 3600-V (D).

CHEMICAL ENGINEERS OR CHEMISTS for analytical work in the laboratory of an industrial firm in Central Ontario. Salary from $175. Veteran preferred. Apply to File No. 3642-V.

CHEMICAL ENGINEER, preferably with sales experience, for sales and service with an industrial firm in Central Ontario. Salary open. Apply to File No. 3642-V.

CHEMICAL OR METALLURGICAL ENGINEERS, from recent graduates up, required by a Quebec firm engaged in metal production for employment as production and development engineers. Salaries open. Apply to File No. 3693-V.

CHEMICAL ENGINEER required for the control department of a paper mill in Shawinigan Falls. Salary from $250-$350. Apply to File No. 3765-V.

CHEMICAL ENGINEER OR CHEMIST interested in textile dyeing, required by an industrial firm in South Western Quebec. Salary open. Apply to File No. 3798-V.

CHEMICAL ENGINEER, required by a chemical firm in Shawinigan Falls, Quebec, for development work on plastics. Salary open. Apply to File No. 3812-V.

CIVIL

CIVIL ENGINEER with experience in the mechanical trades required as designer by a building contractor in Quebec, age 30-35, salary open. Apply to File No. 3444-V.

CIVIL ENGINEER to take charge of work in a drainage district in Quebec. Must be bilingual. May be recent graduate. Salary from $200. Apply to File No. 3479-V.

CIVIL ENGINEER for design work in an industrial plant in the Montreal area with experience in building construction, probably permanent position. salary from $200 up according to experience. Apply File No. 3504-V.

CIVIL ENGINEERS with experience in detailing and designing structural steel and reinforced concrete for manufacturers are required for a steel fabricating company in Manitoba. Salary open. Apply File No. 3519-V.

CIVIL ENGINEERS, recent graduate up, required by a pulp and paper company with plants in Eastern Canada. Salary open. Apply to File No. 3549-V.

CIVIL ENGINEER, age 35-40, with extensive experience in detailing and checking structural steel in buildings and bridges, required by a steel fabricating company in Southern Ontario. Salary open. Apply to File No. 3570-V.

CIVIL ENGINEER with experience in survey and construction, preferably bilingual, required to take charge of the engineering department for the woods operations of a paper company in Eastern Quebec. House available. Salary $350 up. Apply to File No. 3749-V.

CIVIL ENGINEER, qualified O.L.S., required as town engineer and superintendent of works for a town in Central Ontario. State age and salary desired. Apply to File No. 3750-V.

GRADUATE CIVIL ENGINEER, required by a public utility in the Montreal area with three or four years' experience in design of reinforced concrete and structural steel. Salary $250-$300. Apply to File No. 3766-V.

GRADUATE CIVIL ENGINEER, required as structural designing engineer by a firm engaged in the manufacture of cranes, crushers, pumps, etc., in the Toronto area. Preferably with 5 to 10 years' experience in designing and detailing steel buildings and bridges. Salary open. Apply to File No. 3771-V

GRADUATE CIVIL ENGINEER required by an industrial corporation in Montreal for design work in draughting room. Must be familiar with structural steel and concrete design. Position offers good opportunity and permanency to right man. Salary from $250 up according to experience. Apply to File No. 3785-V.

SEVERAL CIVIL ENGINEERS, with two or three years' experience in road construction required for road building work in Northern Quebec. Salary open. Apply to File No. 3804-V.

CIVIL ENGINEERS with some experience on design and field work required by a public utility in Toronto. Salary open. Apply to File No. 3813-V.

CIVIL ENGINEER, age 35-40, with considerable experience in design of structures, water supply, sewers, required by an organization in Montreal. Salary $300-$400. Apply to File No. 3820-V.

CIVIL ENGINEER required to act as superintendent and assistant to general contractor in Shawinigan Falls. Must be bilingual. Salary $300-$400. Apply to File No. 3827-V.

ELECTRICAL

ELECTRICAL ENGINEER, age 32-36, with electrical experience around mines or smelters. English speaking with working knowledge of French, is required by a company in Shawinigan Falls, Quebec. Salary open. Apply to File No. 3415-V.

ELECTRICAL ENGINEER age 30 - 45 with sales training with large manufacturer of electrical equipment instruments and 5-10 years experience as sales service and sales engineer required as sales engineer in Canada for U.S. firm making special equipment for transport and industry. Salary open. Apply to File No. 3447-V.

ELECTRICAL ENGINEER, recent graduate, required for the engineering staff of a paper mill in the Lake St. John area. Salary open. Apply to File No. 3507-V.

ELECTRICAL ENGINEERS, from recent graduates up, required by a company in Montreal engaged in the production of telephone, etc., equipment Veterane preferred. Salary open. Apply to File No. 3551-V.

ELECTRICAL ENGINEER with knowledge of power apparatus, preferably bilingual, required for sales work with a manufacturer in the Montreal area. Salary open. Apply to File No. 3646-V.

ELECTRICAL ENGINEER with considerable industrial experience required as a safety engineer by a public utility in the Montreal area. Bilingual preferred. Salary open. Apply to File No. 3654-V.

ELECTRICAL ENGINEER with several years experience required as a designer by an industrial organization in Montreal. Salary open. Apply to File No. 3677-V.

ELECTRICAL ENGINEER, with general knowledge of a.c. and d.c. motors, switchgear, mercury rectifiers, transformers and other electrical apparatus, for sales work in Eastern Canada, age 30 to 35, salary open. Apply to File No. 3695-V.

ELECTRICAL DRAUGHTSMAN with several years' experience in industrial layouts for large concern in Eastern Townships. Permanent position and attractive salary available for experienced men. Apply to File No. 3701-V.

ELECTRICAL ENGINEER, age about 30, with considerable experience, required by a manufacturer in the St. Maurice Valley. Salary open. Apply to File No. 3723-V.

ELECTRICAL DESIGNING DRAUGHTSMAN with considerable industrial experience and initiative required by an electrical firm in Montreal. Salary open. Apply to File No. 3751-V.

ELECTRICAL ENGINEER with estimating and contract experience, required as office engineer by an electrical firm in Montreal. Salary open. Apply to File No. 3751-V.

ELECTRICAL ENGINEER, recent graduate up, required by a manufacturer in Montreal, for sales engineering. Preferably bilingual and familiar with rotating electrical equipment. Salary $200. up. Apply to File No. 3761-V.

GRADUATE ELECTRICAL ENGINEER with 5 or more years experience in electrical equipment of buildings, required by a consulting engineer in Montreal. Salary open. Apply to File No. 3773-V.

GRADUATE ELECTRICAL ENGINEERS with 3 to 10 years experience in design, operation, layout of substations, switching stations, and electrical machinery, together with engineering studies, including draughting for a large hydro electric power house in Quebec. Salary $225 up. Apply to File No. 3787-V.

ELECTRICAL ENGINEER required for power sales by an electrical utility in Province of Quebec. Preferably experienced. Bilingual. Salary open. Apply to File No. 3802-V.

ELECTRICAL ENGINEER with experience in layout and design of generating and transformer stations, required by a public utility in Toronto. Salary open. Apply to File No. 3813-V.

ELECTRICAL ENGINEER required by a manufacturer in Western Canada to be in charge of production. Preferably between 30 and 40 years with desire to earn or buy interest in the business. Salary $4,000 up. Apply to File No. 3815-V.

JUNIOR ELECTRICAL ENGINEER required by a Montreal firm for inspection of electrical equipment of all kinds, in Toronto area. Salary $225. Apply to File No. 3816-V.

ELECTRICAL DESIGNING DRAUGHTSMAN with broad practical experience and theoretical knowledge required for a firm in Quebec. Salary from $225. Apply to File No. 3818-V.

ELECTRICAL ENGINEER, recent graduate up, preferably with experience in audio circuits design and maintenance also practical knowledge of fractional horsepower motors and wiring layouts, required to eventually take charge of sound maintenance for motion picture studio in Ontario. Salary open. Apply to File No. 3826-V.

MECHANICAL

MECHANICAL ENGINEER, is required for draughting and detail work with a company in central Ontario. Good prospects for advancement. Single man preferred. Salary open. Apply to File No. 3393-V.

MECHANICAL ENGINEERS, preferably with design experience, are required for armament research and development in the Quebec area, in a government establishment. Salary from $190. Apply to File No. 3401-V.

MECHANICAL ENGINEER with experience in pulp and paper or mining work required by a pulp and paper company with plants in Eastern Canada. Salary open. Apply to File No. 3549-V.

MECHANICAL ENGINEER recent graduate, required by an industrial firm in south western Quebec, for the design and erection of complex textile machinery. Salary open. Permanent position. Apply to File No. 3625-V.

JUNIOR MECHANICAL ENGINEERS, required by a Montreal manufacturer of machines and equipment for mechanical type of work such as machine design, etc. Salary $175 up. Apply to File No. 3664-V.

MECHANICAL ENGINEER with experience in the fabrication of Farm Implemente, required by a Quebec firm. Bilingual man preferred. Salary according to experience. Apply to File No. 3666-V.

MECHANICAL ENGINEER with design experience in the pulp and paper industry required by a firm in the St. Maurice Valley. Salary $350. Apply to File No. 3673-V.

JUNIOR MECHANICAL ENGINEER with knowledge of precision machine shop practice and aptitude for research work in metals and plastics required for an organization in Toronto for the production of artificial limbs. Must be veteran. Salary from $225. Apply to File No. 3675-V.

MECHANICAL ENGINEER with industrial or construction experience, required by a firm of consulting engineers to inspect machinery deliveries in the Cornwall area. Salary open. Apply to File No. 3691-V.

JUNIOR MECHANICAL ENGINEER, under 30 and preferably bilingual, required by a Montreal firm to train as sales engineer for pumps, engines and allied electrical equipment. Salary open. Apply to File No. 3714-V.

YOUNG MECHANICAL ENGINEERS, with practical experience either in automotive or general manufacturing industries, together with ability to operate engineering office systems, required by an industrial organization in Ontario. Salary open. Apply to File No. 3732-V.

MECHANICAL ENGINEERS, with at least five years' experience in the Pulp and Paper industry required by an Ontario Paper Company. Salary open. Apply to File No. 3733-V.

JUNIOR MECHANICAL ENGINEER with industrial experience required as assistant to the plant engineer in a factory in the Montreal area. Salary about $225. Apply to File No. 3758-V.

GRADUATE MECHANICAL ENGINEER, experienced in boiler operation, required as assistant superintendent on maintenance of railroad and tramways rolling stock, in the Quebec area. Salary $200. per month. Apply to File No. 3772-V.

MECHANICAL ENGINEER with 5 or more years experience in heating, ventilating and air-conditioning, required by a consulting engineer in Montreal. Salary open. Apply to File No. 3773-V.

MECHANICAL ENGINEER, with paper mill or mining experience required for design and layout by a paper mill in Northern Quebec. Salary $375-400. Apply to File No. 3778-V.

MECHANICAL ENGINEER with considerable experience willing to act as assistant to Mechanical Superintendent of a textile manufacturing concern near Montreal. Salary open. Apply to File No. 3784.-V

MECHANICAL ENGINEER, recent graduate up, required by a Pulp and Paper Company in the Province of Quebec for work entirely centred in logging operations. Salary open. Apply to File No. 3789-V.

MECHANICAL ENGINEER, recent graduate up, required by major oil company in Montreal area. Salary $175 up according to experience. Apply to File No. 3792-V.

MECHANICAL ENGINEERS required by a Pulp and Paper mill at Powell River, B.C. Preferably with experience in plant design in the pulp and paper industry. Salary according to qualifications. Apply to File No. 3796-V.

MECHANICAL ENGINEER required to establish and operate an estimating and planning department for the grinding and machine shop of a firm located in Central Ontario. Experience in tools, dies, and shop work essential. Salary open. Apply to File No. 3801-V.

MECHANICAL DRAUGHTSMAN, with several years experience in machine design, required by an industrial organization in Montreal. Salary $250 up. Apply to File No. 3807-V.

MECHANICAL ENGINEER with at least 10 years experience in design and installation of machinery also supervisory ability required by an industrial organization in Montreal, Salary open. Apply to File No. 3807-V.

MECHANICAL ENGINEERS, with experience in plant layout and design or ventilation problems or general mechanical design, required by a firm in Quebec. Salary from $250. Apply to File No. 3818-V.

MECHANICAL ENGINEER, age 35-40, with considerable experience in design and layout of machinery and equipment, required by an organization in Montreal. Salary $300-$400. Apply to File No. 3820-V.

MECHANICAL ENGINEERS, preferably with experience in machine design, required by a steel fabricating firm in Montreal for design and layout. Salary open. Apply to File No. 3824-V.

MECHANICAL ENGINEER with considerable experience, required to supervise installation of coating machine also design necessary, tankage and piping systems, for a paper mill in Ontario. Salary around $400. Apply to File No. 3828-V.

MECHANICAL ENGINEERS, required by a pulp and paper mill in Ontario for design and layout also mechanical installations. Salary around $300. Apply to File No. 3828-V.

JUNIOR MECHANICAL ENGINEER with sales experience and good knowledge of Montreal, required for sale of power house equipment. Preferably bilingual. Salary $200-$250. Apply to File No. 3831-V.

MECHANICAL ENGINEER, required by a manufacturer in Ontario for the plant operation staff. Salary open. Apply to File No. 3833-V.

MECHANICAL ENGINEER with six to ten years experience in maintenance and engineering work, required by alkali manufacturers in Ontario. Salary open. Apply to File No. 3833-V.

MINING

MINING ENGINEERS, with varied experience required by a firm in Quebec for general mine operation, exploitation and development work. Salary from $250. Apply to File No. 3818-V.

MISCELLANEOUS

MANAGEMENT ENGINEER with business administration and mechanical background, age 30 up, bilingual with at least 5 years practical experience, required by an industrial engineering consultant in Montreal. Apply to File No. 3307-V.

CIVIL OR MECHANICAL ENGINEER with experience in pulp and paper mills, to be assistant to plant engineer in a paper mill in Central Quebec. Salary open. Apply to File No. 3445-V.

TWO STRUCTURAL STEEL DRAUGHTSMEN with five or more years experience in designing and detailing steel structures. State experience and salary required. Location Toronto. Apply to File No. 3451-V.

STRUCTURAL STEEL DRAUGHTSMEN AND CHECKERS, preferably graduate engineers but any experienced men acceptable, are required for a steel fabricating company in Manitoba. Salary open. Apply to File No. 3519-V.

ASSISTANT PLANT ENGINEER with paper mill experience required by a pulp and paper company with plants in Eastern Canada. Salary open. Apply to File No. 3549-V.

GRADUATE ENGINEERS with experience in air-conditioning, heating, refrigeration and allied problems, required by a manufacturer in the Montreal area. Salary open. Apply to File No. 3566-V.

GRADUATE ENGINEERS, required by a large industrial and chemical organization with headquarters in Montreal for all phases of research design, operation, development, production and maintenance. Salaries open. Apply to File No. 3588-V.

ASSISTANT PROFESSORS AND INSTRUCTORS required for the staff of a technical college in New York State. Salary open. Apply to File No. 3600-V. (A)

DESIGN ENGINEERS with experience in reinforced concrete and hydraulic structures for hydro-electric developments for an engineering firm with headquarters in Toronto. Salary open. Apply to File No. 3612-V.

CHIEF ENGINEER with industrial experience required for a steel fabricating plant in Western Canada. Salary open. Apply to File No. 3616-V.

STRUCTURAL AND MECHANICAL DRAUGHTSMAN required for detail drawings by a steel fabricating plant in Western Canada. Salary open. Apply to File No. 3616-V.

DESIGN DRAUGHTSMAN for the design of cranes and hoists of all types, capable of making and checking complete manufacturing detail drawing, required by a manufacturer in Southern Ontario. Apply to File No. 3628-V by letter with full details. Salary open.

SALES ENGINEER with wide engineering experience wanted by a company in Toronto for the sale of textile machinery and construction equipment. Salary open. Apply to File No. 3639-V.

MECHANICAL AND STRUCTURAL DESIGNERS AND DRAUGHTSMEN required by a pulp and paper company in the Port Arthur district. Salary open. Apply to File No. 3653-V.

ASSISTANT ENGINEER with experience in estimates and specifications for industrial work required by a pulp and paper company in the Port Arthur district. Salary open. Apply to File No. 3653-V.

CHIEF DRAUGHTSMAN with at least five years draughting room and related engineering office experience, preferably in pulp and paper or process industries, required by a pulp and paper mill in the Port Arthur district. Salary open. Apply to File No. 3653-V.

MECHANICAL OR ELECTRICAL ENGINEERS for training as production engineers with an industrial firm in Montreal. Salary open. Apply to File No. 3662-V.

GRADUATE ENGINEERS for mechanical design, experimental, test and development departments of a Canadian firm producing aircraft gas turbines. Salary open. Apply to File No. 3667-V.

STRUCTURAL DESIGNERS AND DRAUGHTSMEN required by a firm of consulting engineers in Montreal. Salary open. Apply to File No. 3668-V.

JUNIOR ENGINEERS, recent graduates up, as designing draughtsmen for a brewing company with headquarters in Montreal. Salary from $200. Apply to File No. 3670-V.

CIVIL OR MECHANICAL ENGINEERS with design or structural experience required by a manufacturer of contractors' equipment in the Hamilton area. Salary open. Apply to File No. 3698-V.

JUNIOR ENGINEERS, recent graduate up, required for the engineering staff of a communications company with headquarters in Montreal. Veterans preferred. Salary from $175. Apply to File No. 3713-V.

MINING AND METALLURGICAL ENGINEER, age about 30, with considerable experience, required by a manufacturer in the St. Maurice Valley. Salary open. Apply to File No. 3723-V.

CONSTRUCTION ENGINEER with considerable experience required for the permanent staff of a Montreal inspection company. Salary about $200. Age immaterial. Apply to File No. 3728-V

DETAILER AND DESIGNER for reinforcing steel with considerable experience required by a steel fabricating firm in Montreal. Salary open. Apply to File No. 3740-V.

STRUCTURAL STEEL DETAILER AND CHECKER with considerable experience required for checking shop details by a steel fabricating firm in Montreal. Salary open. Apply to File No. 3740-V.

DESIGN ENGINEERS, age about 30, with experience in the design and layout of chemical plants, required by an industrial organization in the St. Maurice Valley. Salary from $250. Apply to File No. 3741-V.

DESIGN DRAUGHTSMEN, age about 25, with experience in chemical plant layouts, required by an industrial organization in the St. Maurice Valley. Salary from $200. Apply to File No. 3741-V.

SALES ENGINEER, preferably bilingual, required by a Montreal firm dealing in building materials. Salary from $200. Apply to File No. 3745-V.

GRADUATE ENGINEERS, recent graduates up, preferably mechanical, required for the engineering and operating staff of a pulp mill in Eastern Quebec. Salary open. Apply to File No. 3748-V.

PUBLICITY ENGINEER required by an electrical firm in Montreal to organize publicity department and edit trade journal. Salary open. Apply to File No. 3751-V.

GRADUATE ENGINEER required by an insurance company in Montreal for the inspection of boilers, steam plant and allied equipment. Salary from $200. Apply to File No. 3754-V.

TECHNICAL GRADUATE, preferably Mechanical, Chemical or Electrical, under 30, veteran preferred, for permanent position with engineering organization. Training period in U.S. Work will include travelling for consultation among leading industrial plants. Enclose photo when answering. Salary open. Apply to File No. 3759-V.

CHIEF DRAUGHTSMAN with experience in Pulp and Paper Mill design wanted immediately in Port Arthur. Reply stating education, experience. Salary open. Apply to File No. 3760-V.

CIVIL, MECHANICAL OR CHEMICAL ENGINEERS, recent graduates up, preferably with experience in petroleum and heavy industry such as chemical or paper, required by an oil company in Toronto. Salary open. Apply to File No. 3762-V.

GRADUATE ENGINEER, with practical experience, production and maintenance, to take charge of Farm Equipment Factory with Grey Iron Foundry, located in Ontario. Apply with photo or snapshot to File No. 3764-V. Salary open.

STRUCTURAL STEEL DRAUGHTSMAN, qualified to detail and check all classes of structural steel and to supervise draughtsmen in a large drawing office on the West Coast. Salary open. Apply to File No. 3777-V.

BRIDGE ENGINEER, qualified to be in charge of the design and supervision of the construction of highway bridges. Apply stating qualifications, experience, age and salary wanted to File No. 3780-V.

GRADUATE CIVIL OR MECHANICAL ENGINEERS with 3 to 10 years experience in design, cost estimates, draughting, and engineering studies for a large hydro-electric power house in Quebec. Salary $225 up. Apply to File No. 3787-V.

SALES ENGINEER with electrical engineering background in public utility or industrial field required by wire and cable manufacturer for engineering contact work in Ontario. Salary open. Apply to File No. 3788-V giving complete details.

STEAM PLANT ENGINEER for large concern in Eastern Townships, with at least 5 years practical experience. Must be familiar with thermo-dynamics, combustion control, steam turbines, mechanical refrigeration, hydraulics, etc. Permanent position and attractive salary for the right man. Apply to File No. 3791-V.

GRADUATE, with some knowledge of looms, weave construction and cloth analysis, required as manager for rayon weaving plant in Peru. Administrative ability necessary. Knowledge of Spanish would be an advantage although not a necessity. Salary open. Apply to File No. 3794-V.

INDUSTRIAL ENGINEER, with two to five years experience in time-study and job evaluation required by a firm in Montreal making rock metal. Salary $200 up. Apply to File No. 3800-V.

GRADUATE CIVIL OR MINING ENGINEER required to take charge of several small instrument parties, for layout work in New Brunswick area. Salary $350. Apply to File No. 3803-V.

CHEMICAL OR MECHANICAL ENGINEERS, recent graduates, required by an organization in the Montreal area, for experimental and development work, with view to supervisory positions in production. Salary $200 up. Apply to File No. 3806-V.

RECENT GRADUATES OR JUNIOR ENGINEERS with mechanical background, required by a Montreal Engineering, fabricating and contracting firm for training purposes leading to sales and service. Area Montreal. Salary $175 up. Apply to File No. 3810-V.

STRUCTURAL ENGINEER, required by a firm of consulting engineers in Montreal for design work. Must have experience in structural steel and reinforced concrete. Salary open. Apply to File No. 3811-V.

CHIEF ENGINEER required for coal stripping and mining operations in Alberta, would also have responsibilities in highway construction in this Province. Minimum salary $6,000. Apply to File No. 3814-V.

ASSISTANT GENERAL MANAGER to be in charge of all coal development operations in Alberta and some highway contracts. Salary $8,000 to $10,000. Apply to File No. 3814-V.

INDUSTRIAL ENGINEER with broad experience in plant development, operation, costs and management required for a firm in Quebec. Salary from $250. Apply to File No. 3818-V.

GRADUATE ENGINEER, preferably with chemical and industrial experiencee required to supervise operations at the Sodium Sulphate Plant now being constructed at Chaplin, Sask. Salary open. Apply to File No. 3821-V.

DRAUGHTSMEN required by a pulp and paper mill in the Eastern Townships for general draughting and detailing. Three or four years experience preferred but not essential. Salary open. Apply to File No. 3823-V.

DRAUGHTSMAN, preferably with mechanical background, required by a manufacturer in Montreal for design work on electrical equipment. Salary open. Apply to File No. 3829-V.

DEPUTY DIRECTOR OF IRRIGATION, Ceylon, must be Corporate Member of the Institute of Civil Engineers or possess degrees or diplomas recognized by that body. Technical duties include designing, estimating for and reporting on schemes of irrigation water supply and flood protection and checking the construction costs of such schemes. Apply to File No. 3834-V.

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For Eastern Canada, of nationally advertised mechanical product. Excellent opportunity for the right man, willing to study and work on specialized equipment needed in every industry. Secure and prosperous future awaits the right man with ambition and energy. Give fullest information re present employment, training, age, commencing salary expected. Applications treated in strictest confidence. Apply to File No. 3861-V.

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Applications should be addressed to the Dean, College of Engineering, University of Saskatchewan, Saskatoon, Saskatchewan.

Situations Wanted

SECOND YEAR ENGINEERING STUDENT at McGill University, S.E.I.C., forced to abandon, would like to be trained as a sales engineer by a responsible concern. Age 23, single, good appearance and personality, free to travel and bilingual. Apply to File No. 339-W.

GRADUATE CIVIL ENGINEER, M.E.I.C., age 42; P. Eng. in B.C., ten years experience as superintendent and engineer on large building construction, two years design and installation of waterworks, two years municipal and seven years administrative experience. Thoroughly familiar with manufacturing problems, cost accounting, production control, time study and methods, plant layout etc. Excellent record of accomplishment and earnings. At present employed but seeking a permanent position in one of the larger centres of the west coast. Apply to File No. 880-W.

MECHANICAL ENGINEER, M.E.I.C., P.E. Ont., 10 years' experience chemical industry of Ontario. Wishes to locate in West. Apply to File No. 1309-W.

MECHANICAL ENGINEER, M.E.I.C., P.E.Q., age 42, twenty years experience as engineer in pulp and paper mills, maintenance construction and design interested in responsible position in the pulp and paper industry. Apply to File No. 1371-W.

GRADUATE ELECTRICAL ENGINEER, McGill, Jr. E.I.C., P. Eng. (Que.), whose eleven years' experience lie in the fields of specification writing for and supervision of small contract jobs, fire prevention and safety work in heavy and light industry, desires position in production-management line. Recent personal evaluation by prominent firm of Management Consultants in Montreal disclosed high general ability and aptitude for production work. Willing to consider any location in Canada. Age 35. Apply to File No. 1494-W.

PLANT MANAGER, MECHANICAL GRADUATE, Jr.E.I.C., age 34, with a lot of industrial engineering experience including, organization, wage incentive plans, production control, development, cost control, etc., and with special personnel qualifications, seeks position on the east or west coast or in Central Ontario. Intererested in locating progressive organization requiring an engineer to head up a plant. Apply to File No. 1500-W.

CIVIL ENGINEER, M.E.I.C., P.E.Q., would accept work at night. Design and checking of reinforced Concrete structures, estimates, Hydraulic. At present employed in Montreal. Apply to File No. 1527-W.

SALES ENGINEER, Jr.E.I.C., Prof. Eng. Ont. '36 McGill, wants to sell reliable engineering equipment. Agressive, bilingual, age 32, Good engineering background. Apply to File No. 1698-W.

ELECTRICAL ENGINEER, M.E.I.C., with twenty years experience in Sales and Technical Service of Electrical Machinery and Allied Equipment and at present manager of his department, is looking for position with a broader horizon. Apply to File No. 1854-W.

YOUNG CIVIL ENGINEER, M.E.I.C., would accept some work at night at home. Preparation of estimates and tenders. At present employed on construction work. Apply to File No. 2128-W.

CIVIL ENGINEER, B.A.Sc., M.E.I.C., P. Eng., ex-R.C.E. Officer with several years experience in municipal, highway and hydraulic engineering. Presently employed but interested in position with municipality or firm where extensive construction and maintenance work is contemplated. Apply to File No. 2463-W.

ELECTRICAL ENGINEER, M.E.I.C., graduated '34, desires summer employment (May 20th-Sept. 15th). At present teaching in Electrical Engineering Department of a University in Eastern Canada. Experience: 4 years' Power and Telegraph Line Construction, 3 years Assistant Electrical Superintendent in a Canadian Gold Mine, 3 years' R.C.E. Electrical Distribution Layouts. Apply to File No. 2827-W.

MECHANICAL ENGINEER (Sask. '45), S.E.I.C., one year's experience with Consultant Engineering Firm, desires employment in Plant maintenance or design, preferably in the vicinity of Toronto, Montreal or Winnipeg. Available June 1st. Apply to File No. 2829-W.

METALLURGICAL ENGINEER, expert in research, design and management phases of non-metallic mineral industry. Age 41. Experience includes 10 years as manager. Desires connection in similar capacity with reliable concern. Available April 30th. Apply to File No. 2831-W.

GRADUATE ENGINEER, age 39, bilingual, M.E.I.C., P.E.Q., Ex-R.C.E., with extensive experience on staff work involving planning, organization, administration, procedure and secretarial duties. Varied experience in civil, and electrical engineering including planning, coordination and execution of large projects. Would be interested in position as executive or assistant either in engineering or business organization. Apply to File No. 2832-W.

METALLURGICAL ENGINEER, M.E.I.C., with 13 years' experience in light metals, copper, zinc and their alloys, would like to change his position. Experience covers remelt, extrusion, rolling and drawing. Operating as well as research and development work and technical sales service. Interested in a responsible position primarily in sales development work. Would be available on a 2 month notice. Age 39, married, bilingual. Apply to File No. 2844-W.

MECHANICAL ENGINEER, Jr.E.I.C., graduate Queen's 1945, age 24, single. For three summers employed in auto plant maintenance. One year and a half experience in designing and draughting of Hydraulic and Plastic Machinery, estimating. Desires responsible position connected with production or industrial maintenance with a smaller progressive company. Prefers Ontario or Western area. Apply to File No. 2849-W.

CHEMICAL ENGINEER, Jr.E.I.C., McGill '27, married. Experienced manager, in charge personnel, production, purchasing. Synthetic resin research, distillation. Plant and laboratory control, time study, sales. Available immediately. Bilingual. \$4,500. year last position. Apply to File No. 2850-W.

CIVIL ENGINEER, M.E.I.C., O.L.S., R.P.E., B.Sc., age 27, single, ex-R.C.E. officer desires position with Canadian or American firm engaged in structural engineering work to do design, layout and supervision of construction in Canada or foreign countries. Apply to File No. 2851-W.

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CONTENTS

COVER PICTURE

Paralleling photographs which appeared last winter showing the removal of unprecedented amounts of snow from British railways by using jet engines mounted on flatcars, the cover photo depicts a further use of these engines—or, in this case, their combustion chambers—to meet emergency conditions.

During the coal crisis caused by the same unusual weather conditions, a team of 60 men in one week converted seven Lancashire boilers at the Chadderton Works of A. V. Roe and Company Limited, to use fuel oil burned in Rolls Royce Nene combustion chambers. The photo shows three of the seven boilers, each fitted with two of the Nene units.

DEVELOPMENT OF THE JET-PROPULSION GAS TURBINE FOR AIRCRAFT

AIR-COMMODORE FRANK WHITTLE, C.B., C.B.E., F.R.S., R.A.F.

A paper presented at the Sixty-first Annual General and Professional Meeting of The Engineering Institute of Canada in Toronto, Ont., on May 9th, 1947*

This paper covers general theory of jet propulsion, design considerations for the individual components of an engine and the comparisons with the piston engine and propeller combination. A/C Whittle favors centrifugal compressors for gas turbine engines and he gives several of his arguments for this type as against the axial compressor. The importance of the combustion problem is stressed and the paper concludes with a discussion of present status and possible future developments of the turbo-jet engine.

As my audience is one with wide engineering interests I do not intend to go into detail. I intend to present the wood rather than the trees. My purpose is to give a general outline from which the significance of the aircraft gas turbine can be assessed. I shall not have time to deal much with the history although parts of it will be brought out in the course of the lecture in illustrating particular features. Another object is to stimulate discussion by stressing certain characteristics which I favour against the views of others in the field.

The gas turbine working on a constant pressure cycle consists basically of a compressor, a combustion chamber and a turbine. The purpose of the gas turbine when used as a jet propulsion engine is basically the same as that of the piston engine and propeller, namely to take air in at the front and to expel it to the rear with increased velocity. The thrust is given by $\frac{m}{g}(v-u)$ and the propulsive efficiency is $\frac{2}{v/u+1}$ where v = velocity of the exhaust gases, u = the forward speed of the aircraft and m = the mass flow.

Figure 1 illustrates the drawing filed with my original patent application in 1930. I include this because it serves the double function of illustrating the principle of operation and a keystone in the history. It is also of interest in view of the present controversy over centrifugal and axial flow types of compressors because it shows that, in those days, I was sitting on the fence in proposing two stages of axial flow and one of centrifugal.

The compressor takes in air, compresses it in a pressure ratio of about 4 to 1 and discharges it to the combustion chambers, where the air is heated and its volume increased by the steady burning of injected fuel. The temperature rise in the combustion chamber is such to give a maximum temperature of 800 to 900 deg. C. From the combustion chamber the gases expand in two stages. The first stage of expansion is through the turbine, imparting sufficient energy to the shaft to drive the compressor. The remaining expansion represents the useful energy and takes place in the final nozzle, where the gases reach a velocity of the order of 1600 to 1800 ft. per sec. when the engine is stationary and 2000 to 2400 ft. per sec. in high speed flight.

There is nothing new in the gas turbine as such, but it is only within the last ten years or so that it has become a practical proposition. There were numerous attempts at the beginning of the present century to make practical gas turbines but they all failed because the efficiencies of compressors and turbines were not good enough and because suitable materials were not available for the high temperatures necessary. The use of the gas turbine as an aircraft engine is favoured by the extra degree of compression at high efficiency that can be obtained by the ram effect of forward speed and by the low temperatures at high altitude that make possible a greater positive to negative work ratio for a given maximum cycle temperature. It should be noted that although the aircraft gas turbine has been first utilized in simple jet propulsion, it can also be used to drive a propeller or ducted fan in the manner of a reciprocating engine.

I will not dwell here on the early experimental work, which culminated in the first flight of the Power Jets W1 engine in the Gloster-Whittle E-28/39 aircraft in May 1941, but will pass to the Power Jets W2-B engine which was the prototype of the Rolls-Royce Welland which subsequently powered the Meteor 1, and of the General Electric Type I engine which powered the Bell P59A. Figure 2 shows a general arrangement of this engine which consists of a centrifugal impeller coupled to a single stage turbine with a reverse flow combustion chamber arrangement. It will be seen that the impeller is double-sided, a design which was adopted in order to allow the maximum possible throughput of air for a given outside diameter—a point which will be discussed more fully later on. The air is induced through curved intake vanes. A particular feature of the intake ducts is a set of small blades at the outside which give the entering air a velocity component in the direction of rotation to reduce the relative velocity at the tip of the impeller eye. These prewhirl vanes are particularly advantageous when the compressor is operating at high altitude where the atmospheric temperature is low and therefore the corresponding local velocity of sound is low and the Mach number is high.

After passing through the centrifugal impeller, the air enters a set of diffuser vanes which convert the major portion of its kinetic energy into static pressure. The combustion chambers, ten in number, are arranged on the counter flow principle, that is to say the flow in the flame tube is in the opposite direction to the flow between the flame tube and the outer casing. This means that the entry section of the flame tube is remote from the delivery port of the compressor allowing more time for the air distribution to equalize, a factor which has been found very important on all combustion chambers from that day to this. Its other advantages are the elimination of an expansion joint between compressor and turbine and reduction in the length of

*Due to unforeseen circumstances, no verbatim record of Air Commodore Whittle's lecture was obtained. The *Journal* is indebted to Mr. D. G. Shepherd of A. V. Roe, Canada Limited, who compiled the published version from the speaker's notes.

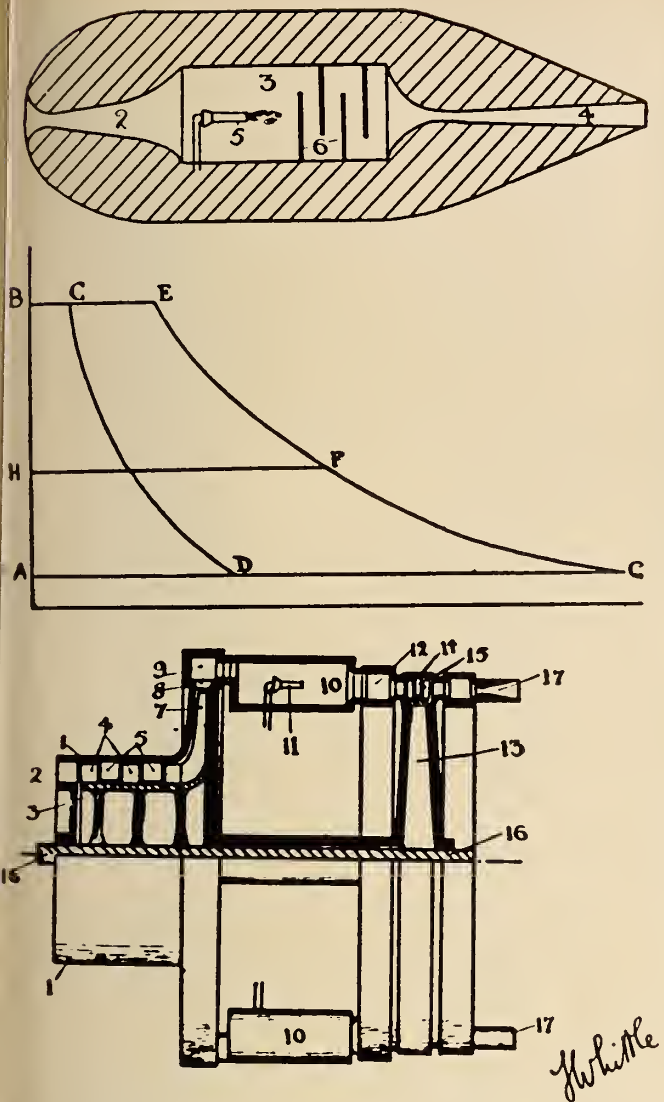


Fig. 1. Reproduction of drawings illustrating British Patent No. 347, 206, filed 16 Jan., 1930.

the engine. Since the shaft is quite short there is no necessity for an intermediate bearing between the main compressor and turbine bearings.

The fuel system of this engine is very simple, consisting essentially of a pump, a throttle and burners (fuel injectors). There is also a speed limit governor and a barometrically controlled relief valve which reduces the fuel line pressure with altitude in order to maintain a reasonably constant range of throttle movement. The fuel used for aircraft gas turbines is, and continues to be kerosene, which I favour very strongly for its safety features as opposed to gasoline.

The single stage turbine is based on free vortex design (i.e. the nozzle blades are set to impart a whirl component of velocity inversely proportional to the radius) and has a high axial leaving velocity, since this can be utilized in the case of jet propulsion. The turbine disc is air cooled, air being passed over the front face of the disc by means of a set af vanes attached to the disc, which act as a small centrifugal compressor. From the turbine the gases pass down the exhaust cone assembly whence they pass along the jet pipe to the final nozzle.

The engine is started by a small electric starter motor similar to those used on automobiles.

There are only two main bearings, both of the anti-friction type, the front one taking the net thrust. The lubrication system is simple and the lubricating oil consumption is very small, of the order of ¼ pint per hour.

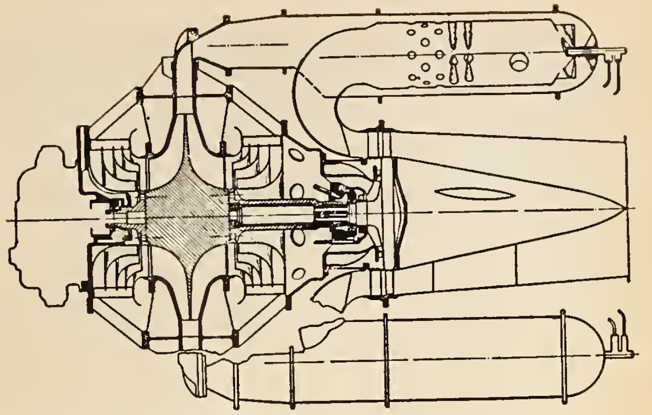


Fig. 2. General arrangement of an early engine—the W2B.

Figure 3 shows the rotor assembly of the W2/700 engine which was the final development of the W2-B type. The impeller is made of R.R.59 aluminium alloy and has 29 blades. I believe in having the greatest number of blades possible consistent with manufacturing requirements since I believe that the beneficial effect of the reduced blade loading on the aerodynamic performance outweighs the losses due to increased skin friction on the greater surface area. The tip speed of this impeller is about 1500 ft. per second and its diameter is 20.68 in. The pressure ratio is just over 4 to 1 at sea level and an adiabatic efficiency of over 75 per cent is obtained, which is a considerable improvement over the very low figures which were quoted as the limit of performance at the time we started work on this type of engine.

The turbine has 54 blades and the material is Nimonic 80, which is basically an 80-20 nickel-chrome alloy. The materials for both compressor and turbine have given very satisfactory performance. The blades are fixed to the turbine disc by serrated roots (Fig. 4) —usually referred to as a " fir tree " fixing. The manufacture of this type of fixing is not difficult. The serrations in the disc slots are formed by broaching and the blade roots may be either broached or ground to shape on the crush grinding principle.

It is interesting to compare the performance of the W2/700 with its prototype, the first flight engine WI. The latter produced a thrust of only 850 lb. and

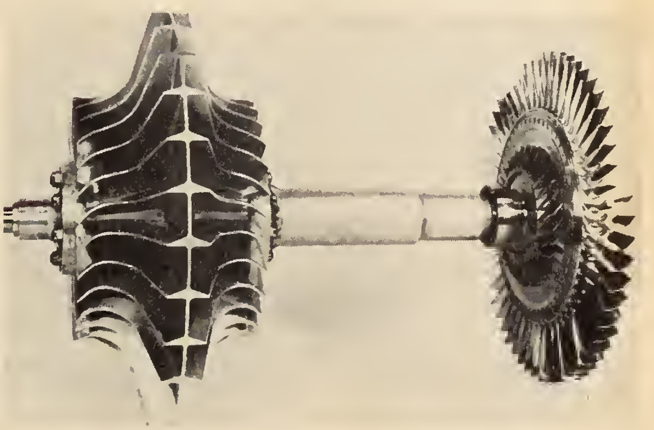


Fig. 3. Rotor of the W2-700 engine—the last of the reverse flow combustion types.

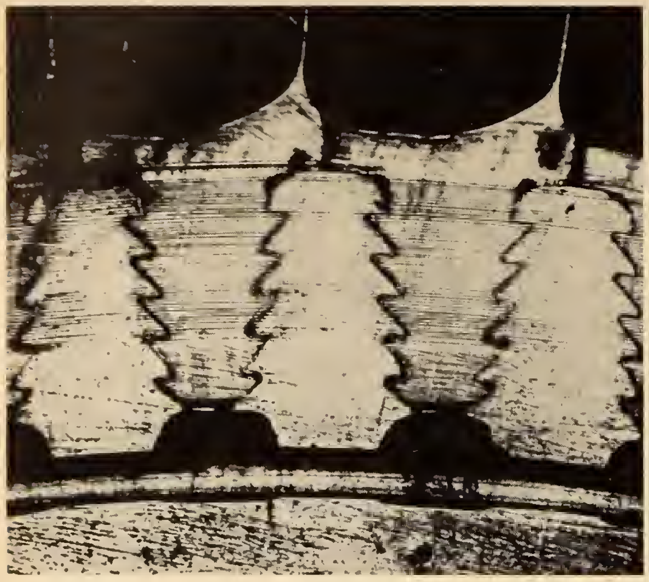


Fig. 4. Serrated or "fir tree" attachment of blades to turbine disc.

had a weight of 650 lb., whereas the W2/700 produced a thrust reaching 2500 lb. for a weight of 930 lb., both units having a diameter of 41 inches. Thus in a little over three years the thrust was nearly trebled in proportion to the size, but that by no means represents the limit of progress. The Rolls-Royce Derwent V which is only slightly larger than the W2/700 produces a thrust of about 4000 lb. The Rolls-Royce Company continued with the development of this type of engine and the Derwent V is the best known of the series having a double sided centrifugal compressor and straight through combustion chambers. This was the engine which enabled Britain to gain the World's Speed Record and to raise it again in September 1946 to an official figure of 616 mi. per hr. At 600 mi. per hr. the Derwent V produces an effective thrust hp. of about 5000. To produce the same effective thrust hp. at that speed, a piston engine and propeller would have to produce a shaft hp. of about 9000 because the propeller efficiency would not be more than about 55 per cent. The fully installed weight would be about 18,000 lb. while that of the Derwent V is only about 1250 lb. That illustrates the outstanding advantage of the jet propulsion gas turbine, namely its extremely low weight and size in proportion to power. The power developed by the turbine in the Derwent V is about 10,000 hp. at sea level. The Rolls Royce Nene is similar to but larger than the Derwent V and develops a static thrust of 5000 lb. It has recently been most effectively demonstrated in the Nene-Lancastrian. This is a Lancastrian in which the outboard Merlins have been replaced by Nenes. Though the purpose was only to provide a flying test bed for the Nenes nevertheless the direct contrast which it provides between normal power plant and the turbo-jet has probably produced more converts to the jet than anything else so far. Another well known engine of the centrifugal type is the de Havilland Goblin which has a single sided compressor and straight-through combustion chambers. It is rated at 3000 lb. static thrust and is the power plant of the Vampire. The de Havilland Ghost engine is newer and larger than the Goblin. It has a generally similar arrangement but produces a stationary thrust of about 5000 lb.

The axial flow compressor engine is represented by the Metropolitan Vickers F2 engine (Fig. 5) which is a typical example of this type. Fig. 6 shows the rotor of the F2, which has 9 axial compressor stages and a two-stage turbine, the pressure ratio being about 4 to 1. The axial flow compressor is analogous in principle to a reversed turbine, having alternate sets of fixed and moving blades, many stages being necessary since the diffusing nature of the flow requires the stage pressure ratio to be kept small.

The advantages of gas turbine jet engines may be summarized thus:—

1) Very low power plant weight, as instanced by the Derwent V mentioned previously.
2) Efficiency and power increases with speed whereas, with the reciprocating engine and propeller, both power and efficiency fall off at high speeds chiefly due to loss of propeller efficiency as a result of compressibility effects.
3) Very favourable effects on aircraft design particularly in the reduction of drag due to better streamline characteristics and the absence of propeller slipstream, and also due to the possibility of having a small undercarriage.
4) A very much reduced fire risk due to the use of a high flash point fuel such as kerosene.
5) Reduced noise and vibration. This was particularly noticeable in the Lancastrian installation, where those on board found it difficult to believe that the jet engines were running after the inboard Merlins had been stopped and the propellers feathered.
6) Negligible consumption of lubricating oil. Some existing types of reciprocating fuel pumps require 1 per cent of lubricating oil to be added to the fuel but I do not regard this as a necessary permanent feature.
7) Low first cost. This should be very much less than for a piston engine and propeller, especially in the case of the very simple engine with a centrifugal compressor.
8) Improved reliability and reduced maintenance. Jet engines are intrinsically more reliable and easier to maintain and service. For example, the establishment for engine maintenance personnel in the jet fighter squadrons

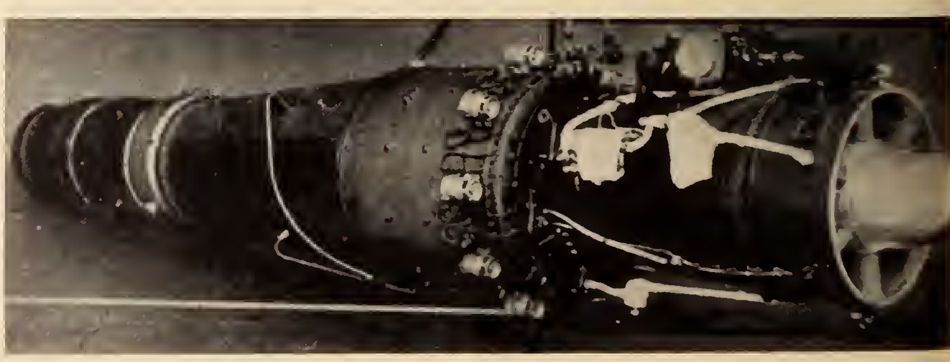


Fig. 5. The Metrovick F2—an early axial flow type.

of the Royal Air Force is half that of the piston engine fighter squadrons.

9) Ease of installation. The installation is very simple and uncomplicated by elaborate cooling systems, etc. It is possible to change an engine in two hours or less, and much of this is the time required for undoing and refastening the cowlings.
10) Easy starting. The jet engine is very easy to start and does not require warming up. Neither is it necessary to run up to full power as a check before take-off, although I am afraid it will be a long time before that habit dies out.
11) Simplification of controls. In effect there is only one control, the throttle, and all the elaborate control apparatus of piston engines is eliminated.
12) Very short development time. This is at least true for engines with centrifugal compressors. For example, the Derwent V ran up to full speed and gave its design performance only 4½ months after the drawings were started. Three months later it passed its 100 hour test and two months later it powered the Meteor IV aircraft which broke the World's Speed Record. Although this was a remarkable performance and should not be taken as a general rule, it emphasizes very strongly the possibilities of rapid development. Moreover, with this type of engine, when a particular problem is solved for one engine it is often solved for all engines of similar type. Another important factor is that they are very amenable to scaling—that is to say, if an engine is required similar to one already in existence but of different power, then it can be quickly obtained from the existing engine by scaling up or down.

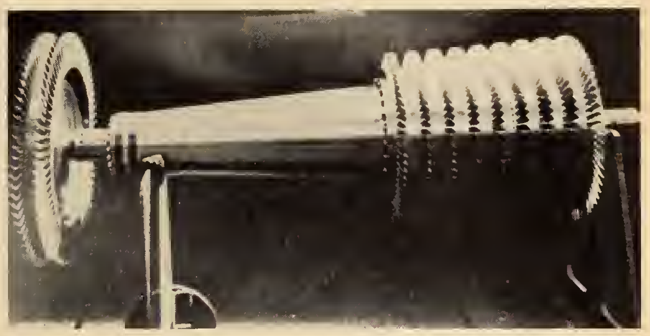


Fig. 6. Rotor of the Metrovick F2.

There are many possible arrangements of the components of jet propulsion gas turbines and some of these are shown in Fig. 7. The first example shows the double-sided centrifugal compressor in combination with counter flow combustion chambers. I have already mentioned the advantages of the latter which were a very necessary part of the early development since they allowed us to eliminate some of the problems at that time. The disadvantages of the counterflow combustion system are an increased pressure loss in the return elbow and the effect on the overall diameter of the engine. It has now been superseded by the straight-through type. Another figure shows the use of a single sided centrifugal impeller as used on the de Havilland engines. Those who favour the single sided impeller argue that although the diameter of the compressor is large in proportion to mass flow, this is partly offset by the fact that there is no need to provide space around the outside of the blower casing for air to pass to a rear intake. They also argue that the pressure losses between the entry of the intake duct of the aeroplane and the eye of the impeller are reduced. On the other hand advocates of the double sided compressor, of whom I am one, argue as follows:

1) That it is intrinsically more efficient than the single sided one, chiefly because its breathing capacity is much larger in proportion to the internal " wetted " surface.
2) That it makes possible a much lighter and smaller engine.
3) That it makes for improved matching of the compressor and single stage turbine running at the same speed since both tend to have limiting characteristics at the same time which is a very advantageous design feature.
4) That a very much better mechanical job can be made of the impeller due to its balanced construction.
5) That the intake pressure losses can be as low or lower than that of the single-sided compressor by arranging that ram compression is obtained before entry into the engine compartment.
6) That the rotor has a much smaller end thrust.

The intake efficiency of the ram type of entry, as on the E28/39 and Meteor aircraft, has proven to be very high and there is less susceptibility to damage by the ingress of foreign bodies than with the high velocity type of intake used with single sided impellers.

Figure 7 also diagrammatically illustrates the type

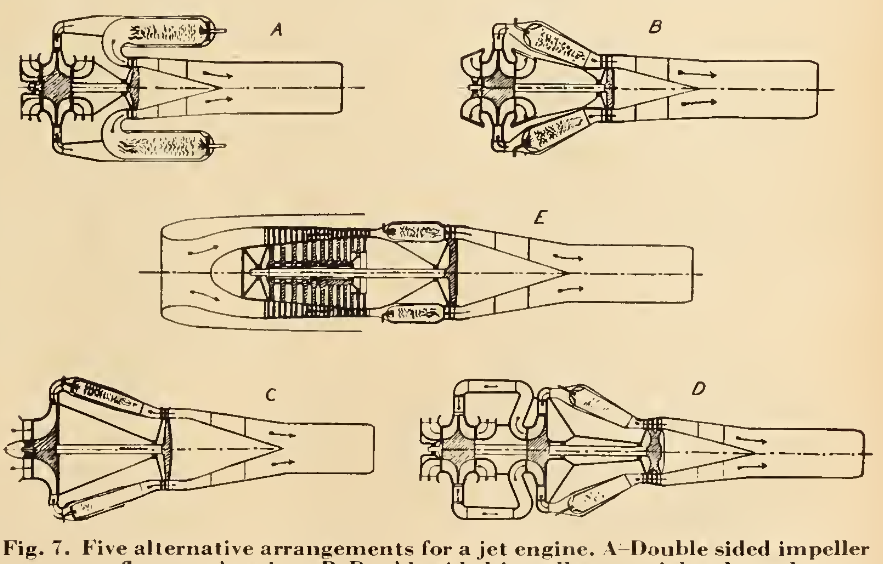


Fig. 7. Five alternative arrangements for a jet engine. A–Double sided impeller—counter flow combustion; B–Double sided impeller—straight-through combustion; C–Single sided impeller—straight-through combustion; D–Two-stage centrifugal compression, straight-through combustion, two-stage turbine; E–Axial compression, straight-through combustion.

of engine with an axial flow compressor. The arguments of those who favour this type are that it provides a lower overall diameter, a higher compressor efficiency and therefore a reduced fuel consumption. I still favour the centrifugal type for several reasons, one of which is the critical operating characteristics of the axial flow compressor which renders matching with the turbine difficult and which in a number of instances have required the use of special devices such as "blow-off" valves and variable nozzles in order to overcome the unstable operation which so easily occurs. Although higher peak efficiencies may be obtained on the compressor alone they are not easily realized in an engine and the fact remains that no axial flow engine has yet bettered the fuel consumption of the best of the centrifugals. Also, to date they have always been substantially heavier in proportion to power. Manufacture of axial flow compressors is more difficult resulting in a higher first cost. The development time is longer and the blades are much more liable to failure due to the entry of foreign bodies and to icing, as well as the intrinsic difficulties of vibration and flutter. The starting of such engines is a more difficult problem due to the inertia of the rotor and the surging characteristics. Finally, there is no law of nature which says that centrifugals cannot be efficient. Nevertheless, I admit that the axial flow engine will eventually play its part but I would advise designers to ensure that they have a compressor available which has been fully tested and developed on a rig before they design a complete engine around an axial flow compressor.

Another possible arrangement is one in which a 2-stage turbine drives a 2-stage centrifugal compressor, the first stage compressor being double sided and the second single sided. This is one of the probable future developments to obtain higher compression ratios.

The combustion chamber is one of the main components which limited development in the past but which, although still imperfect, has now reached a reasonably satisfactory state. Figure 8 shows one of the types developed by the Joseph Lucas Company which is widely used today. This is a straight-through type of chamber and air enters at the front in the region of the fuel burner where the primary combustion takes place, diluting air being mixed gradually as the gases proceed towards the exhaust. In the early stages of development we attempted to use a combustion chamber based on the injection of vapourized kerosene, i.e. the "Primus" principle, but eventually had to abandon it in favour of a system based on the injection of an atomized spray of fuel. The intensity of combustion required for these engines is far beyond anything usual in commercial practice and now reaches a value of over 2×10^6 Chu* per cu. ft. per hour per atmosphere. Moreover a large quantity of excess air must be used since the total air is about five times that required for complete combustion and this excess air must be mixed so as to provide a uniform temperature distribution at the turbine nozzles. It is also essential to obtain the lowest possible pressure loss since this directly affects the efficiency of the engine. We have found that it is most important to preserve symmetry about the burner axis, both in relation to the air flow and the disposition of the mechanical parts themselves. Most engines use a number of combustion chambers of circular section, each comprising an outer casing with a flame tube and burner concentric with it. However some designs have favoured an annular type of combustion chamber, arguing that a very much smaller diameter can be achieved and that it fits in very much better with an axial flow compressor and axial flow turbine. I personally have always avoided it because the development problems are very much more severe than with the multiple chamber system. With the annular combustion chamber it is not possible, with any certainty, to do development work by tests of a small section of the total combustion system in the way it is possible to do single chamber tests of the multiple chamber system. Moreover, I am a great believer in complete symmetry about the axis of the fuel nozzle.

*Centigrade heat units.

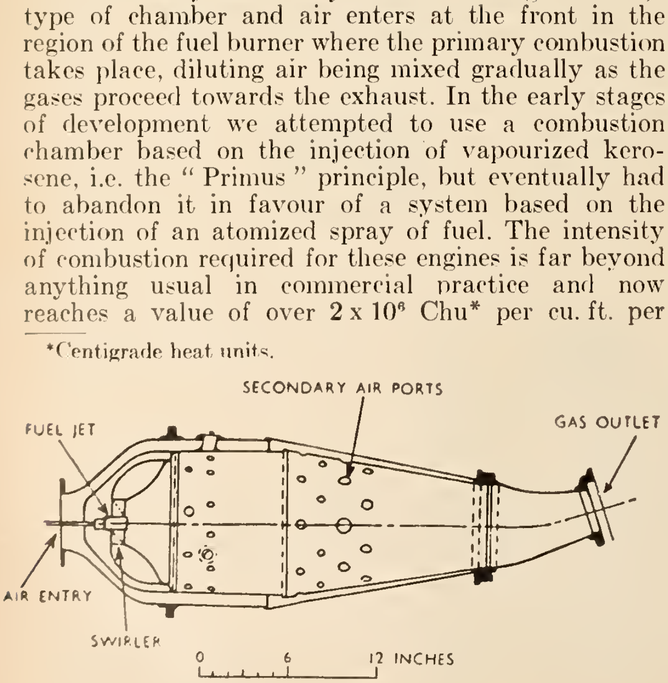


Fig. 8. Joseph Lucas type combustion chamber.

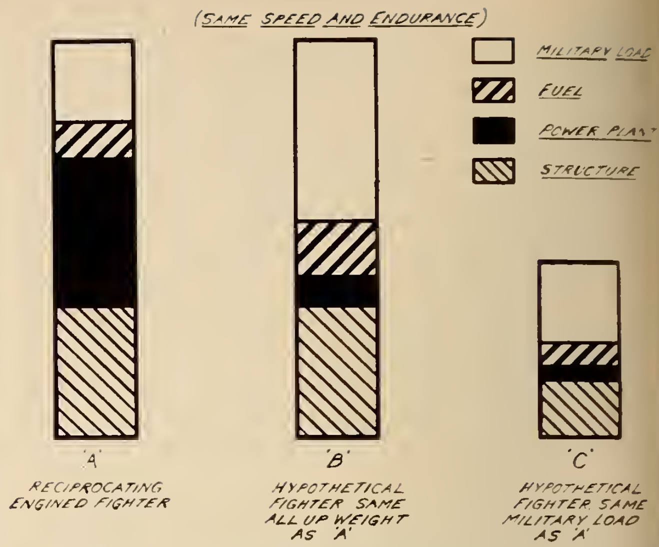


Fig. 9. Weight distribution for piston engined and jet engined fighter aircraft.

Figure 9 illustrates the important point, that a large proportion of an aeroplane is required to carry the power plant and fuel. Comparisons between different types of power plant are often made on the basis of thermal efficiency or fuel consumption per unit power, etc., but, in an aeroplane, this is a totally false basis of comparison. It is easily possible that in particular types of aeroplanes the fuel consumption, expressed in terms of power, for one power plant may be substantially higher than another, and yet, because the apparently less efficient power plant may make a smaller aeroplane possible for the given duty, it may be more efficient when fuel consumption is measured in terms of useful load and distance.

At 'A' is illustrated the approximate weight distribution of a modern fighter with piston engine and propeller. The military load including pilot is 20 per cent and the power plant and fuel accounts for 47 per cent—37 to the power plant and 10 to the fuel. Structure weight represents 33 per cent., but part of

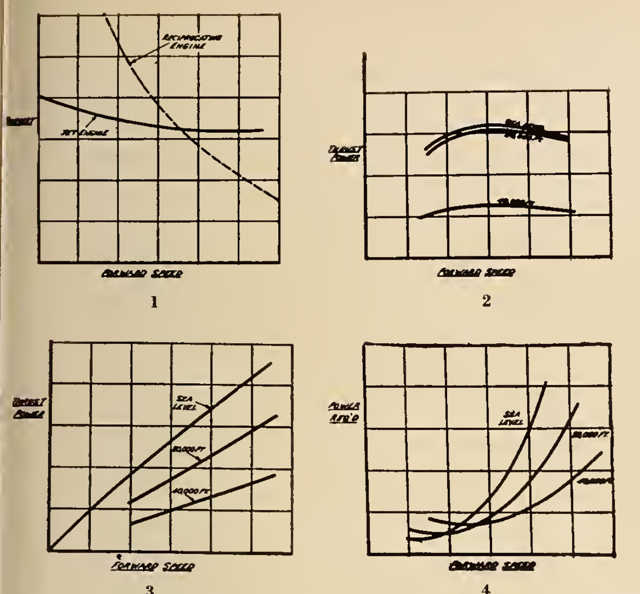


Fig. 10. Speed-power curves for typical aircraft. 1. Thrust vs. speed (jet and piston engines); 2. Thrust power vs. speed (piston engine); 3. Thrust power vs. speed (jet engine); 4. Power required vs. speed (for typical aircraft).

the structure weight is debitable to power plant and fuel, so that some 70 per cent of the total weight is directly or indirectly attributable to the power plant.

In diagram ' B ' is illustrated the weight distribution of a hypothetical aeroplane for the same speed and endurance at the same height, having a hypothetical power plant which consumes about 50 per cent more fuel in proportion to power, but which is only one fifth the weight in proportion to power. In the second case the amount of fuel is 50 per cent greater than in the first, but the military load is 127 per cent greater. ' C ' shows the reduction in size we get if we make our hypothetical aeroplane to carry the same military load. In the second case the ratio of useful load to fuel is about 50 per cent better than the first. I have taken a short range aeroplane of high performance to illustrate this point. For greater ranges things move in favour of the heavier power plant with the lower fuel consumption, but I hope I have made it clear that a comparison between two power plants should not be made without reference to the duty which the aeroplane has to perform.

The efficiency of the jet engine as a device for producing a high velocity jet is quite high. The overall thermal efficiency measured in terms of the increase of kinetic energy produced by the engine, in the air passing through it, can be of the order of 34 per cent when flying in the stratosphere where the maximum benefit is obtained from the low temperature of the atmosphere, but because the speed of the jet is very much higher than the speed of the aeroplane, the propulsive efficiency is low. The thrust of any device which obtains thrust by engaging a mass of fluid and forcing it to the rear with increased velocity is proportional to the rate of change of momentum induced, but the power expended is proportional to the rate of change of kinetic energy induced. Hence it is basically more efficient to induce a small increase of velocity in a large mass of fluid than to induce a large increase of velocity in a small mass of fluid. The jet speed is usually of the order of three times the forward speed and at this condition the propulsive efficiency (the ' Froude efficiency ') is about 50 per cent, giving an absolute overall efficiency of about 17 per cent. This is better than one could obtain with a piston engine and propeller at speeds of the order of 600 miles an hour, because at those speeds the propeller efficiency would be unlikely to be more than 60 per cent. At lower speeds however the overall efficiency of the jet engine is definitely lower than that of the piston engine and propeller. Both the thermal efficiency and the propulsive efficiency improve with speed so that there is a double reason why high speed is necessary for efficiency. Height improves efficiency up to the stratosphere at least, because of the low atmospheric temperatures, but generally speaking, speed is much more important than height in its effect on efficiency. At 600 miles an hour the turbo jet engine is the most efficient propulsive device for aircraft that we have available, even if we think purely in terms of fuel consumption per unit effective horsepower. The importance of speed in relation to power and efficiency is illustrated by Figs. 10 and 11.

I have emphasized that high speed is necessary for the efficiency of a turbo jet engine, but near the ground, where the air is dense, high speed requires enormous power and hence very high fuel consumption. To get high speed with relatively low drag it is necessary to fly very high. Height is of tremendous importance in its effect on the range of the jet engined aeroplane; so much so that at about 40,000 ft. the range is nearly three times as great as it is at sea level. The effect of speed on range is relatively small so that you might as well fly fast because there is nothing to be gained by flying slowly. The range of the aeroplane with conventional power plant on the other hand is very sensitive to speed but not very sensitive to height, though the speed corresponding to maximum range increases very considerably with height.

So far the turbo-jet engine has found its chief application in interceptor fighters. Of the British jet fighters the Meteor and the Vampire are already well known. A new one, the Supermarine E10/44, flew in public for the first time a few months ago. It is a single engined aeroplane; the general arrangement being somewhat similar to the Lockheed P80. The engine is the Rolls-Royce Nene of 5000 lb. static thrust. A new high speed experimental aircraft is the

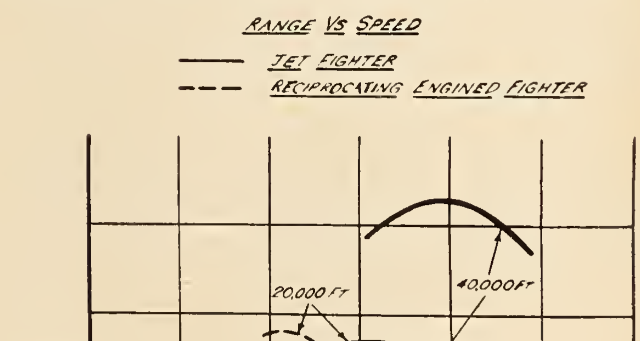


Fig. 11. Range vs. speed for jet and piston engines.

Fig. 12. Flight testing of jet engines—an Avro Lancastrian flying on two Nene engines in the outboard positions. (The inboard Rolls Royce Merlins are stopped and their propellers feathered.)

de Havilland D.H. 108 which is being used to obtain data on flight at high Mach numbers.

Although I believe that jet propulsion will be used for high speed aircraft of the future, a great deal of work has been going on both in Great Britain and in America on gas turbines for propeller drive and several engines are now in an advanced stage of development. In fact, many permutations and combinations are possible and a third way of using gas turbines for aircraft propulsion is to use a ducted fan. This is really a compromise between the pure turbo jet and the turbo prop in which the gas turbine drives a low lift compressor inside a hollow fuselage or nacelle. Whereas a propeller produces a slipstream of very large mass with only a small increase of velocity, and the jet engine produces a low mass high velocity jet, the ducted fan produces something in between the two, so that its propulsive efficiency lies between that of the pure jet and the propeller. A forward speed of about 400 mi. per hr. is the point at which the ducted fan shows a better performance than the propeller, or possibly lower than this if the reduced drag of an aircraft with a ducted fan is taken into account. It has the advantage of not producing interference with the engines as does the propeller and there is an absence of vibration and noise. Another advantage of the ducted fan is that it is possible to obtain a very large temporary increase in power by burning additional fuel in the low pressure air from the fan. The fuel consumption is very large when this is done but this is not important where the boost required is purely temporary, as, for example, for take-off or for short periods during combat.

However, the aeroplane with the ducted fan has not yet been developed while propeller gas turbines are now coming into the picture. One of the best known of these is the Bristol Theseus engine, which is the first British propeller gas turbine to pass the official 100 hour type test. In the Theseus, the propeller is driven through reduction gearing by a turbine mechanically independent of the compressor. It also has another distinctive feature in that it may be fitted with a heat exchanger by which the low pressure exhaust gives up some of its heat to the air from the compressor, the result being a substantial reduction in fuel consumption. However, its use results in additional bulk, weight and complication and in my opinion can only be justified on very long range aeroplanes.

Other well known British propeller gas turbines are the Armstrong-Siddeley Python and Mamba. The former has a total equivalent bhp. of about 4000 and the Mamba which is a much smaller engine, is a little over 1100 bhp. Both engines have axial flow compressors and the propellers are driven from the main turbine-compressor shaft by reduction gearing.

The outline I have tried to give you of the aircraft gas turbine situation has necessarily been very sketchy. It would not be possible to give an adequate treatment in the time available, but I hope I have said enough to convince you that the piston engine is dead for aircraft propulsion except possibly in the field of light aeroplanes. I make this reservation because we do not know enough yet about the problems involved in designing gas turbines of very low power. At present it seems easier to design for much higher powers than we are using today than to design for power of the order of 200 hp.

We are as yet only at the beginning of this field of engineering. The possibilities are immense. In the piston engine the compression, combustion and expansion, all take place in the one organ, the cylinder, and that seriously limits the possibilities of variation. In the gas turbine these processes take place in specialised organs, each of which can take many forms. As you have seen, you can have centrifugal compressors, axial flow compressors, or combinations of the two types. There are wide possibilities of variation in combustion chambers and turbines and many ways in which these major components can be combined. Added to all these are the possibilities involved in heat exchangers, intercoolers and so on.

The next few years will see rapid developments in the aircraft field as a result of the advent of the aircraft gas turbine. I believe that speeds of the order of 500 to 600 miles an hour will soon be quite common in commercial aviation. However, in order that this may be done satisfactorily, it is vitally important that satisfactory pressure cabins and adequate radio aids to navigation be developed concurrently.

DISCUSSION

D. G. Shepherd[1]:

I should like to say a few words about the combustion problems which happened to be my particular interest when I was working at Power Jets Limited—Air Commodore Whittle's firm in England. It was my great good fortune to be able to work with the Air Commodore in his early days in the development of this engine. We worked under extremely primitive conditions because there was a lack of support in those days. Therefore, it depended entirely on our efforts and our approach was essentially empirical.

A/C Whittle has pointed out that it is still not possible to design a combustion chamber on the drawing board and expect it to work. That is very true. We made literally hundreds of experiments on different types of combustion chambers. We tried them at the rate of perhaps two and three ideas a day. We have learned that it is better to settle on a design and at least devote sufficient time to prove its worth or otherwise.

We—and I think I may associate Air Commodore Whittle with this—knew nothing about combustion in those days. In fact, eventually we were provided with rubber boots because there was more fuel on the floor than was going out the engine exhaust as gases. We have learned a little since then and we have a number of guiding rules for use in deciding the size and shape of the combustion chamber for a given engine. But it is all based on experience, and as yet, I must say there is extraordinarily little science in gas turbine combustion. We do in these days talk about heat balances; we use gas analysis and occasionally we talk about rates of flame propagation. When we really want to impress people we start talking about reaction rates. In the end, however, it boils down to blowing some air through a piece of sheet metal, supplying fuel and seeing what happens.

One of the important unsolved problems is that of combustion at high altitude. The two main reasons for failure of combustion at extreme altitude are: (1) in general the combustion chamber uses a supply of fuel which is atomized by pressure. At altitude very little fuel is required and, on the old square law principle, atomization becomes poor at very low flows; (2) combustion at sub-atmospheric pressures deteriorates very badly, so that the object at the moment is to obtain at altitude the good combustion which is now achieved under other conditions.

Combustion efficiency under most of the working conditions is still not very good and should be improved if possible. We would still like to reduce the pressure loss because it is supposed to be a constant pressure combustion system. That would improve the efficiency. Better endurance would be desirable for the combustion chamber, although that is satisfactory now and I believe, for instance, that the inspection period for this component is about 200 hours for current Rolls Royce engines.

The other question which is being debated is the method of fuel injection. The very earliest experiments with a vaporized system of combustion were very similar to the "primus" stove—which, on the surface, would seem very advantageous because if the fuel could be injected as gas the problem would be half solved. Fuel was put through tubes inside the combustion chamber where it was supposed to vaporize and issue from the orifices as a gas, but condensation on the combustion chamber being somewhat uncontrollable — some parts of the tubes were cold and some overheated — the result was either liquid fuel or burned-out tubes and this system was discarded in favor of atomized injection of a liquid fuel.

Another system is to inject fuel, not necessarily atomized, mix with air and vaporize with heat before the actual combustion and that, I think, is what may be useful in the annular chamber. This chamber is not adapted to the system of circular symmetry obtainable with an injector, but, by vaporizing first, fuel delivery can be made in any desired pattern.

Another problem concerns the type of fuel to be used. Kerosene has been used to date and, compared with highly explosive gasoline, it affords a distinct advantage in experimental work.

In the early days all sorts of unmentionable things were done with kerosene that just would not have been possible with gasoline. In fact it was intended then to be able to use perhaps even a diesel fuel, but that was ruled out on account of the freezing question. It was never anticipated, however, that gasoline would be required.

Although we might like to use kerosene the question of availability has to be considered, and the problem, particularly here in Canada, of the very low freezing point that must be obtained.

To recapitulate, the three points that we are still worried about are the combustion at altitude, the type of fuel injection, and what fuel we are going to use.

Mr. Shepherd further considered the combustion problem, a phase of development in which he has specialized. Mr. Standerwick paid high tribute to A/C Whittle and touched on metallurgy and manufacturing problems. Mr. Parkin dealt with the problem of icing in which field his division of the National Research Council has done experimental work. Prof. Allcut emphasized the combustion problem and added further comment on the axial vs. centrifugal issue.

In his reply the speaker added to Mr. Standerwick's praise of the metallurgists and contended that Mr. Parkin's comments in regard to icing would assist the argument in favor of centrifugal compression. He supplied some turbine blade design figures in reply to Prof. Allcut and cited one of the German gas turbines which is believed to have been subject to surging troubles with a resulting high accident rate due to very poor response to the throttle.

R. G. Standerwick[2]:

While we were in the midst of the war, and while we of the General Electric Co., were busying ourselves building superchargers for the various aeroplanes, we were suddenly given a package of prints that had been flown over from England which disclosed to us for the first time what this kind of a jet propulsion unit really was.

If the prints had not been in reasonably good shape

[1] Chief Experimental Engineer, Gas Turbine Engineering Division, A. V. Roe, Canada, Ltd., Malton, Ontario.

[2] Chief Engineer, Aircraft Gas Turbine Division, General Electric Co., Lynn, Mass.

we would have had a much more difficult task because we work in different ways on this side of the Atlantic to what they do over in the Old Country. First angle projection is the standard over there, and we had to transfer all the prints to third angle. We had to put on nomenclature that was foreign to us, we had to interpret this, and we also had to secure all the materials in this country. We had a tremendous amount of help from Air Commodore Whittle, who came over in 1942, and also from engineers from all the leading companies in England who were working on aircraft gas turbines.

A C Whittle has referred to controversial issues in his talk for example axial versus centrifugal compressors. At General Electric we were building centrifugals. Our exhaust turbo supercharger had a hot turbine on one end and a centrifugal compressor on the other, and it was logical that our engineers should know something of what was going on in the new engine. Presumably this is why the first prints were handed by General Arnold to our Company.

In our particular plant we have two very active Engineering Divisions, one dedicated to the progress of axial flow compressors, and the other to centrifugals, so I am not going to say whether there is any real controversy between the two. I prefer to say that what we learn in axial may help us in radial, and vice versa. I think perhaps some day a combination of the two might work out.

I agree heartily that the problems of combustion are numerous and our engineers are working on them all the time. We are hoping that the life of these burners can be extended even beyond the reliable 200 burning hours at present attainable.

The problem of metallurgy should also be mentioned. If it had not been for the progress made by our metallurgists in the early part of the war the gas turbine might not have been practical even yet. I have seen as many as four hundred different metals tested in a year by our company—that is, the average high temperature alloys. They were all to be used for blading material. I have seen cases of good results for only two or three out of four hundred tested. The problems are numerous in this respect. " Impervium " is a material which is still in the future—that kind of material which will withstand all kinds of stresses at all temperatures. We have the name but we haven't the material yet.

To go further, there are the problems that are facing our manufacturing people. We are all up against a new era in tool design and techniques of fabrication. Great credit is due to the metallurgists all over the world, but, more so, to the manufacturing people who have devised the most unique methods of manufacturing and, in America particularly, adapted them to mass production. After seeing the results achieved by the jig and tool designers, I feel that the future is very bright.

I would be wrong if I left you with the impression that it was just we who build the engines who have the problems. The men using them are facing new problems totally unknown in the past. Mach Numbers of 1.2 and 1.8!—we are expecting to get up there some day! Some of you may have heard the broadcast discussion which I had with G. Geoffry Smith some 10 months ago. I was telling of our endeavours to break through the trans-sonic wall, and how the Bell XS-1 was expected to be the first U.S. aircraft to go up through that region. I imagine in the future we shall be hearing more about the XS-1 or the other models which are to come, one of which is expected to fly straight up at twenty miles a minute. Smith said to me, " You are talking about pilotless missiles, of course ", and I wish I had had an opportunity of discussing it with him again because five days later the XS-1 flew at better than 550 miles an hour and it did have a pilot in it. I know the programme is for the supersonic planes to be piloted. Pilots of the Royal Air Force, and of our own Air Forces in the United States deserve the greatest possible credit for without their daring, what would be the use in building these aircraft and engines and straining to get up to these high speeds and high altitudes.

There is nothing more fitting that I can say of these inventions of Air Commodore Whittle than that they have raised a tremendous number of problems in many fields of endeavour. They have also created a goal at which a team, not just in England, not just in Canada, but in the United States as well, is working together to one end. That in itself is very, very necessary in these days, as we all know. I know of nothing which has brought science, industry and engineering together in any finer way than this problem of jet propulsion.

Now, I also bring with me, I am sure, from all my colleagues, not only in the General Electric Company, but those in the other companies who are associated in this work, our well wishes to you engineers who are working on these things in Canada, and also our grateful respect and good wishes to our good friend, Air Commodore Frank Whittle.

J. H. Parkin, M.E.I.C.[3];

Air Commodore Whittle has given us a paper of particular interest, and one that is particularly timely for Canadian engineers.

The speaker necessarily limited his discussion to the presentation of the aeronautical applications of the gas turbine and these are very important indeed. But I think that he would agree that there are other applications in the future which will likely be far more important than the aeronautical applications, and these are of definite interest to Canada. Industrial applications, supplementing our hydro-electric power, and in railway work for locomotive propulsion.

There is a characteristic of the turbine which is of particular interest in a climate of this kind for locomotive applications. The steam locomotive loses a large part of its power in the winter time which is the time when additional power is required.

On the other hand, the power of the gas turbine increases as the temperature goes down, because of the increased density of the air which it breathes.

There is a factor in connection with the aeronautical application of the gas turbine which is important in the Canadian climate, and that is the problem of icing. The gas turbine, as the Air Commodore points out, draws in huge volumes of air. The fuel-air ratio is very, very great. If that air contains moisture in vapour or drop form, condensation may occur near the freezing point and ice may be deposited on the compressor entry or some place on the compressor. So far as I know there is no reported case of a turbine-driven aircraft having encountered icing conditions in flight. On test beds there have been instances of icing

[3] Director of Mechanical Engineering, National Research Council, Ottawa.

and some work is proceeding here in Canada on that phase of it, because it is of great interest to Canada by virtue of its climate.

Work is being done in cooperation with the Royal Canadian Air Force, on the ground under simulated icing conditions, and while the amount of work done so far is limited, there have been some interesting indications of what may be expected from ice in gas turbines. The work so far has been on the axial type of engine and the results bear out to some extent the speaker's contention that it is a very delicate mechanism.

There have been two occasions when ice accumulated on the intake of the gas turbines. The test happened to be on a German type axial type and it was responsible for the complete destruction of the compressor—every blade was removed.

I am not sure that the same difficulty of a different type would not be encountered in the centrifugal, unless the entry of this type can be cleared of the intake guide vanes which are presently used on some models. In the German engine used in the test, there is a streamlined or bullet-shaped housing, for the starting motor in the center of the intake, and it has been found under certain conditions that the ice builds up on this housing in a mushroom or sometimes a rose-like formation, and spreads out radially to practically close off the entry and asphyxiate the compressor.

In other conditions, if the speed is lowered from the normal cruising speed to idling, the deposition of ice occurs not only at the entry to the intake, but projects in and forms on the first row of blades. On these blades, the ice will build out from the edges to close off the entry and in one case it became dislodged and stripped the entire moving system of blades off the compressor.

It is a difficult problem to cope with. Some work has been done using alcohol, but it requires a very large amount of alcohol to keep the intake clear. Because of the huge consumption of air the deicing systems already developed to use heat, would mean virtually heating all of the outdoors. It is an important problem and to the best of my knowledge has not yet been satisfactorily solved.

I thought that this phase might be of interest to Canadian engineers, and in closing I should like to express my personal appreciation of the very interesting and competent review of A/C Whittle's developments in connection with the gas turbine We all owe him a tremendous debt of gratitude for his perserverance under extremely adverse conditions a perserverance which might well be cited as an example for coming generations of engineers.

Prof. E. A. Allcut, M.E.I.C.[4];

If genius is truly " an infinite capacity for taking pains ", Air Commodore Whittle is justly entitled to that designation.

Each component of the gas turbine (compressor, combustion chamber, turbine and regenerator) offers different problems, mostly in fields relatively unexplored, and progress consequently had to be made on a step by step basis. Each component had to be studied and designed separately. High speeds, enormous heat releases, high temperatures, and large air flow may be dealt with individually without too much trouble, but a combination of them provides engineering problems of the first order of magnitude.

[4] Prof. of Mechanical Engineering, University of Toronto.

The combustion chamber is probably the most difficult problem, with heat releases of 2 to 4 million B.T.U. per cu. ft. per hour as compared with 20 thousand or so in a pulverized coal furnace. Combustion must be complete at all loads and speeds, and therefore the fuel is relatively inflexible, as its burning characteristics must be closely defined and controlled. With kerosene there is also the possibility of an explosive mixture forming above the fuel in the tank and this may offset its inherent safety. It is evident that if liquid fuel injection is to be used, individual combustion chambers give the best form of distribution and may be essential, though annular combustion chambers are better from an aerodynamic standpoint.

The efficiency of the turbine depends on the maximum temperature, which is far lower than that of the internal combustion engine. It has been stated that the maximum temperature allowable is about 1400° F. (though higher temperatures have been claimed in some instances) but we are seldom told for how long the blades will stand a temperature of this magnitude. Also, with impulse turbines the temperature in the combustion chamber is considerably higher than that of the gas entering the blades (possibly 300-400° F.). We are seldom told which of the two temperatures is referred to. Can Air Commodore Whittle tell us what are the possibilities of ceramics which have been tried in Germany? Also water injection, either to the compressor or combustion chamber has been suggested, but I should expect with such devices some trouble with corrosion or erosion.

Presumably the closed cycle, with its greater flexibility in the use of fuel and the possibility of employing a monatomic gas is out of the question for aeronautical work, though it has possibilities elsewhere. Regenerators or heat exchangers have been used for improving thermal efficiency, but these appear to be large and heavy. Has any progress been made with the light rotary type which was developed in Germany during the war?

The shaft speed of 15000-17000 r.p.m. is reminiscent of the early work of De Laval and obviously implies considerable difficulty with vibration and blade support. If surging takes place in the compressor, these difficulties are likely to be accentuated.

Air Commodore Whittle is evidently a convinced supporter of the centrifugal compressor, but axial compressors have many advantages which have established them in land practice. If the blades strip in axial compressors, the result is inconvenient, but if a centrifugal rotor bursts, it is disastrous. What is Air Commodore Whittle' opinion of the Lysholm type?

As indicated by Mr. Parkin, icing difficulties are likely to be pronounced, particularly at high speeds and altitudes. With air flows averaging many tons per hour, a relatively small percentage of ice can do a lot of damage.

The characteristics of the gas turbine may be summed up as power, simplicity and lightness, and these are excellent characteristics. However, I cannot help feeling that Air Commodore Whittle's views are coloured somewhat by his experience and training as a fighter pilot. I think that the piston engine will be with us for a long time yet. The doom of the steam engine has been proclaimed many times in terms just as emphatic as those used by Air Commodore Whittle but, like Charles II, it is " an unconscionable time a-dying! "

The Author:

First I would like to thank Mr. Shepherd for his remarks on the combustion problem. As one of the leading members of my team in the early days, he is well qualified to speak on the subject. I am sure it must be a matter of considerable pride to him as it is to me and other members of the team that we broke the back of this great problem by the end of 1940. In the early days we had the help of Laidlaw, Drew and Company, a Scottish engineering firm and later of Mr. I. Lubbock and other engineers of the Asiatic Petroleum Company.

I also thank Mr. Standerwick for his remarks. I am particularly grateful for his emphasis of the metallurgical problem. We owe a great deal to the metallurgists for their improvement of turbine materials in the past few years. Much of the improvement in performance is directly attributable to the production of better materials and we look forward to further advances in the near future.

I also agree with Mr. Standerwick that these engines have produced a number of manufacturing problems the solution of which has been an important part of the development. I am proud to claim that the Power Jets team has made big contributions in this field also. In particlar we developed a blade profiling machine which was subsequently adopted by other firms. As Mr. Standerwick said there is still plenty of room for further development in this field.

I agree with Mr. Parkin that the gas turbine has a very wide application though it is in the aircraft field that it shows its greatest superiority.

With reference to the icing problem, we still do not know where we stand. I do not think there is any doubt that whatever the difficulties may be, they will be greater with the axial flow type of engine than with the centrifugal. Mr. Parkin's remarks tend to confirm this. Our experience suggests that centrifugal engines may be relatively immune from icing troubles. At Whetstone we have a full-scale test rig on which, among other things, we can do high altitude tests on compressors. The air to the high altitude test cell is admitted through moisture removing apparatus which is not fully effective. The result is that, during tests, we usually have a shower of snow in the test chamber. For some strange reason this builds up only on the upper half of the front intake screen of the double sided compressor and there is no detectable effect on blower performance. In any case I don't think a centrifugal compressor would mind small lumps of ice going through it. Much worse things have gone through them at one time or another without doing serious damage.

In reply to Professor Allcutt my remarks are as follows:

Fuel

I believe that a considerable range of fuel could be used from the combustion point of view and as I have already indicated it is not so much the combustion as other characteristics which determine our preference for kerosene, namely low freezing point and safety.

With reference to the possibility of an explosive mixture forming above the fuel at certain altitudes in the case of the kerosene, it seems to me that this would easily be avoided by having a very small quantity of a more volatile fuel present in the fuel tank (not necessarily mixed with the kerosene). The presence of its vapour would make the mixture too rich to be explosive.

Turbine Blade Temperatures and Stress

I cannot give exact figures for these but we usually design for stress and temperature conditions which would give a rate of creep of less than 1 per cent per 1,000 hours. The operating temperature of the turbine blades at full speed is in the region of 650 deg. C. and the maximum stresses are of the order of 12 to 14 tons per square inch.

We have many times considered the use of ceramics but to my knowledge the results of such work are not very promising as yet.

We have experimented with water injection but only for the purpose of obtaining temporary increase of thrust for take-off or combat.

Regenerators

We have given a good deal of thought to the rotary type of regenerators with which the Germans were experimenting, but so far as I know the very considerable problems involved have not been solved.

Blade Vibration and Support

The 'Fir Tree' type of blade fixing has proved very satisfactory. We did, at one time, have consirerable trouble with blade failures which appeared to be due to vibration. But generally speaking it is not a serious problem on the turbines of jet engines. It is a much more serious problem in axial flow compressors where, owing to aerodynamic requirements, the blades are very slender. I agree with Professor Allcut that if the blades of a centrifugal compressor fail, the result is much more disastrous than blade failure in axial flow compressors. We did at one time have quite a number of blade failures on the centrifugal impellers and the resulting damage was normally very extensive, but stiffening of the blades eliminated this type of failure. I think it is safe to say that if a design is successfully cleared on the test bench there should be no danger of blade failure in the air.

The Lysholm Compressor

I know very little about the Lysholm compressor. From what has been published it seems that it may be useful in certain land and marine applications of the gas turbine, but I am of the opinion that its breathing capacity in proportion to its weight and bulk is not good enough to consider it for use in an aircraft application.

In reply to Professor Allcut's concluding remarks I agree that my views are very definitely influenced by my experience as a pilot, but I think the development has benefitted considerably from that fact. It has for example, always been a matter of very great importance to me that an engine should have a very rapid response to the throttle because this may mean the difference between life and death in a number of situations. The Junkers engines in the M.E.262 were very unsatisfactory in this respect and it is believed that this was the chief reason for the large number of fatal accidents with the German jet aeroplanes.

I do not predict the complete elimination of the piston engine by any means, but I do think that it will be completely displaced in all aircraft, except for light aeroplanes, during the next few years.

NOTE—The two following discussions were not presented at the Toronto meeting, having been obtained in writing subsequent to the meeting. They are included because of the authors' particular qualifications to present the views of the only Canadian organization presently engaged in Gas Turbine development work.

Winnett Boyd[5]

The paper which A/C Whittle has presented is most timely as this subject is becoming increasingly more prominent in Canadian Aviation circles. I am sure I speak for my entire staff when I say that this lecture will serve as an inspiration to all of us.

I cannot fully share the opinions of A/C Whittle on the advantages of the centrifugal compressor, but I must confess to being only a recent convert to the axial flow type, since my early training was obtained at Power Jets Limited. I can therefore recognize the merit in many of his arguments. It would appear to me, however, that he over-promotes the centrifugal compressor in order to counteract the disproportionate amount of effort that is being devoted to the axial flow type at the present time. It is very right, none the less, that the amount of work on the axial flow engine should be increased since it appears to have certain fundamental advantages over the centrifugal engine for certain aircraft applications. In spite of "the axial engine of the year after next being compared with the centrifugal engine of the year before last" the fact still remains that the compressor, rather than the combustion system, controls the diameter of the centrifugal engine. Thus the axial engine has a very marked advantage when frontal area is considered, and it will therefore always be a factor in the multi-engined jet aircraft used as bombers, long range patrol fighters and high speed mail and transport planes. Until such time as the compressor ceases to be the controlling factor in the diameter of centrifugal engines, the axial engine will have a marked advantage for these applications. In such applications, the question of fuel economy is also paramount and consequently great efforts will be made to develop the axial engine since fundamental calculations indicate that it should have a marked advantage in this respect. It should not be misconstrued that the axial engine has actually demonstrated this superiority because, in fact, the centrifugal engines have been able to hold their own in this respect up to the present time. Whereas the axial engine appears to have the advantage where low frontal area and minimum fuel consumption are paramount, the centrifugal engine has distinct advantages where high specific output and short length are the most important considerations. Since the modern high speed short range fighting plane is approaching the penguin in general confirmation, i.e. a rather large fuselage with relatively small and stubby wings, the centrifugal engine can be easily contained in fuselage and thus it is the ideal power plant for this type of plane.

In closing I would like to suggest that it is as futile to argue the merits of the centrifugal over the axial engine as it is to compare spark ignition and compression ignition engines. Each has its own applications, and I am sure that A/C Whittle will agree with me that engines must be chosen for each distinct job. Trying to compare thse two basic types of engine on a common basis must always work to the detriment of one or the other, depending upon the basis chosen.

[5]Chief Designer, Gas Turbine Engineering Division, A. V. Roe Canada Ltd.

P. B. Dilworth[6]

Mr. R. G. Standerwick has paid deserved tribute to Air Commodore Whittle for his valuable assistance in 1942 when the General Electric Company started on jet engine development in the United States. It is probably not known to the majority of Canadians that we owe a similar debt to Air Commodore Whittle and to his former colleagues at Power Jets Limited.

Canada first became apprized of the British jet engine developments in January, 1943, when representatives of the Canadian Government were provided access to various firms engaged in this work in the United Kingdom. The first establishment visited by these Canadian representatives was Power Jets Limited at Lutterworth and Air Commodore Whittle himself gave a first-hand account of the nature and history of the work up to that time.

Since then many Canadians have had occasion to visit both the Lutterworth and Whetstone establishments of Power Jets Limited, recently nationalized as the British National Gas Turbine Establishment. Some thirty Canadian civilians and service personnel have taken courses of instruction on Gas Turbine theory, design and development at this same establishment. A number of men were privileged to work on various aspects of design and development at Power Jets and the N.G.T.E. for periods up to eighteen months. The majority of these men upon their return to Canada took up duties, first with Turbo Research Limited and latterly with A. V. Roe Canada Limited, who are carrying on the jet engine design and development activities begun by Turbo Research.

Power Jets supplied as well, a considerable quantity of valuable technical information resulting from their work, and similar technical data are still made available to Canada by the National Gas Turbine Establishment. This technical information is, of course, vitally necessary in the design and development of technically competitive gas turbines.

I am sure that all Canadians will endorse this acknowledgement of the invaluable assistance rendered us by Air Commodore Whittle and his former colleagues and successors at Power Jets Limited and the National Gas Turbine Establishment.

[6]Manager and Chief Engineer, Gas Turbine Engineering Division, A. V. Roe Canada Ltd.

DUST CONTROL IN TERMINAL GRAIN ELEVATORS

J. M. FLEMING, M.E.I.C.

President, C. D. Howe Company Limited, Consulting Engineers, Port Arthur, Ont.

An address presented before the Calgary Branch of The Engineering Institute of Canada, February 13th, 1947

The author deals with the causes of dust explosions and the materials which produce them. Frequencies of dust explosions in the United States and Canada are compared. Various codes to guard against explosions are mentioned. Research to date on the behaviour of dust is touched on, and the safety measures necessary for preventing explosions are discussed. Details of a typical dust control system in a grain elevator are given and the high expense of installation is shown to be justified.

The problem of industrial dusts has been present for a long time and involves many types of industries. Such dusts are produced in the process of manufacturing or handling of materials. In general, the handling or processing of many food products, spices and drugs, wood, paper, fertilizers and rosins, soaps and waxes, carbon, coal and metals produces dust which is considered more or less hazardous from the point of view of explosions. The industrial dust problem is in need of control from the standpoint of health of employees, the recovery of valuable dusts or the explosion hazard. In so far as the explosion hazard is concerned, it is estimated there are about 30,000 plants in Canada and the United States subject to such dust hazards. These plants normally employ one and a half million people and have an annual value of products of $11 millions. It is intended, in this paper, to confine the subject to agricultural dust produced from grains in the operation of terminal grain elevator plants.

Dust Explosions Less Frequent in Canada

The record of grain elevator explosions in the past is a matter of continued concern by owners, operators and designers. According to records, dust explosions in grain elevators in the United States from 1900 to 1946 numbered 177, with a loss of 123 lives and injury to 320 persons. The property loss totalled about $42 millions. The grain explosion record in Canada is not as lengthy, including in all about six serious explosions. At the Canadian Lakehead, after more than sixty years of operation, one major explosion occurred in 1945.

Many elevator men in Canada were convinced that we could not have a major explosion. Our lower temperatures and humidities were considered a factor, and the small amount of corn handled in Canada compared to the United States was claimed as the main reason. Corn dust explosions in the United States have been more common than for any other grain, but all grains are involved. Some grain men went so far as to say that dust from our grain would not explode, but this theory was not supported by laboratory tests.

Codes Set Up to Guard Against Explosions

Since 1925, an advisory code of practice for the control of dust in various industries has been set up by the National Fire Protection Association in the United States, an Association of Industry, Underwriters and Research, to provide rules and regulations and methods of design to prevent dust explosions. This code is not law in any state but on the whole it is practised by industry. It is also used in Canada to a large extent on new construction. Many elevators built prior to the code, however, do not meet requirements or advised practice in several important features.

Since the explosion in Port Arthur in 1945, the Ontario Department of Labour, in cooperation with the terminal industry in the province and with the help of expert advice, has set up a new grain elevator code which was approved and made law in the province on July 20th, 1946. This code uses as a basis, the National Fire Protection Association code, but is made mandatory throughout, and many of the provisions apply to elevators constructed before the date of the code. This is the first attempt of any state or province to regulate the dust explosion hazard in an industry by law. The new code is considered to be quite practical and will result, when the installations are made, in a considerable improvement in the conditions within an elevator and a great reduction in the dust explosion hazard. It will mean, however, a considerable expenditure of money by the industry to make such improvements.

What Causes Dust to Explode

It will be useful to discuss briefly research on grain dust explosions. All grain dusts are combustible and are subject to explosion when suspended in air, and when an external source of heat, sufficient to burn the particles of dust is applied. Dust explosions are not spontaneous. From the initial point of the burning of the dust particles, the explosion is propagated by the burning of adjacent particles. This rate of propagation can reach a speed of six to seven thousand feet per second.

A dust explosion, therefore, consists essentially of pressure produced by the rapid burning of dust suspended in the air. When in a confined space within a building, this rapid burning and resultant pressure rise can result in tremendous damage. Such pressure can reach five tons per sq. ft. in a fraction of a second. The rate of burning of the dust cloud is affected by the size, ease of ignition, and the heat of combustion of the dust particles. The concentration of dust in the air is also a factor. In most cases the resultant pressure is due mainly to the expansion of the products of combustion and residual air from the heat of the rapid combustion.

Explosion of grain dust can occur over a wide range of dust concentrations, the lower limit being where there are not sufficient dust particles to propagate an explosion, and the upper limit where there is not sufficient oxygen content to burn the concentration of dust. It is generally considered that a concentration of 1/20 of an ounce of dust per cu. ft. of air will not propagate an explosion, but such a concentration of dust can be exploded in the laboratory.

Dust explosions can be caused by a great number of external sources of heat such as any open flame. metal sparks, hot bearings, electrical sparks from apparatus, and even static electricity. It is essential that all possible sources of heat within an elevator be safeguarded.

Much Research Conducted on Dust Behaviour

Considerable research has been done on the explosiveness of industrial and agricultural dust, principally by the U.S. Department of Agriculture. Referring to their Bulletin 490, from results of laboratory tests, we find the following pressure can be produced: On exploding wheat dust, with a concentration of 100 oz. per 1000 cu. ft. of air, the maximum pressure produced is 20 lb. per sq. in., with a maximum rate of pressure rise of 311 lb. per sq. in. per second. Using the same dust with a concentration of 500 oz. per 1000 cu. ft., the maximum pressure is 46 lb. per sq. in. and the maximum rate of pressure rise is 720 lb. per sq. in. per second.

Similar results are obtained with corn, barley and oats. Corn dust produces the highest pressures. These tests are made by exploding dust in an enclosed bomb and by measuring the resultant pressures at time intervals. Most results shown in the Bulletin are based on an average of three tests. From this experimental work it is evident that all combustible dusts are definitely hazardous, and that the pressure produced is so high that no type of building construction can withstand it.

There are many features of operation that can improve or control conditions. The suspended dust in the air, if ignited, will result at least in a minor explosion. This initial explosion disturbs dust that may be present on the floors, walls and ledges in the building, which then becomes suspended and may result in a much more serious explosion, all of which occurs in a very short interval of time.

Safety Measures Necessary

It is quite important therefore, that the elevator plant be maintained as clean as possible and that static dust throughout the plant should be removed daily. All sources of heat must be controlled by the operators. This includes a rigid "no smoking" rule, protection from incidental fires due to friction on bearings, belting and pulleys, heated grain, metallic sparks from tramp metal and protection from any exposure hazard such as sparks from locomotives and heating plants.

The superintendence of an elevator is an important factor in the degree of care taken in such precautions and continual employee education is necessary to maintain proper standards. The older elevators however, present an almost hopeless task to the operators in so far as housekeeping is concerned, as the accumulation of static dust during a busy day would keep a large staff steadily employed merely in cleaning up the plant.

It is important that all apparatus in an elevator, particularly electrical apparatus, be dust tight, eliminating the hazard from electrical sparks, and also that lighting fixtures be dust tight, with globes of sufficient size to reduce the temperature on the surface of the glass to a safe point.

Safety Stressed in Modern Design

In the design of modern elevators, there are several features that provide safety both in reducing the possibility of explosion and in the immediate relief of pressures that may develop from an explosion. All bins, spouts and points where grain streams are present should be enclosed as far as possible to prevent dust getting into the atmosphere of the elevator, and adequate ventilation to the outside air provided from such enclosed spaces.

Reinforced concrete is today the almost universal material used in terminal elevator construction. Explosion venting in the walls is provided by large areas of windows, with pivoted sections designed to blow outwards at very low pressure. The Code requirement for some years has been to provide a minimum of one sq. ft. of explosion venting area in the walls for each 80 cu. ft. of air volume within the building on each floor. This is quite possible in all floors of an elevator except in basements, where the maximum is provided consistent with structural stability of the building.

All grain bins should be covered with floors and ventilation to the outside air provided. It is quite important to provide all parts of the elevator with adequate window ventilation. This ventilating area should be one half the explosion venting area, that is, one sq. ft. for each 160 cu. ft. of air volume within the elevator.

Dust Control in Grain Elevators

There is, however, in operation of the terminal, a considerable quantity of grain dust that cannot be controlled by any other means than a positive air suction. The term "dust control system" is really applied to such devices providing these air suctions. Such a system reduces to a small degree, the amount of dust that is liberated and settles on the floors and reduces the housekeeping problem to a point where it is quite possible to maintain a clean elevator without the employment of special labour. It should be stressed that a dust control system must also have good housekeeping practice to maintain the desired result.

In general a modern dust control system includes the application of air suction at every point in a grain elevator where grain dust is liberated from the grain stream into the air, as well as the collection of all such dust to a central bin for shipment or disposal. This includes also the collection of dust removed from the grain in the grain cleaning machinery.

How the Dust is Handled

Such systems are subdivided into separate units, each with its own fan and motor and devices to suit the component parts of the elevator. Suction is applied at grain receiving pits, elevator boots and loaders where grain is discharged to conveyor belts or discharged from one conveyor belt to another belt or elevator boot. They are also applied on trippers where grain is discharged from a conveyor belt to a row of bins, on shipping spouts and on distributing spouts from scales or garners to bins.

This suction is achieved by placing hoods around the points of discharge of grains and by connecting these hoods to trunk lines of suction piping. The air and dust is drawn into these suction lines and transported to the fan. Ahead of the fan, traps are provided to drop out the heavier material, particularly grain, that may get into the system. The air and dust goes through the fan and is blown to a dust collector of the cyclone type. The air and dust within the collector has a swirling motion which causes the dust to settle to the bottom of the cone. The air with a small percentage of very fine dust is discharged out through the top of the collector to the outside air. All of the various units employ this same method and devices.

The removal of the dust from the cyclone collectors is accomplished by a suction pipe at the bottom of the cone. This draws the dust from the cone and transports it through a pick-up fan unit to a similar cyclone collector located over the dust bin. From this dust bin, the dust can be shipped out in the usual manner or taken away to be destroyed. In terminal elevator practice, the dust is usually mixed with refuse screenings for shipment. The dust itself has a fair food value, and at most times is too valuable to destroy.

Dust Control Expensive But Justified

Dust control systems, therefore, are an application of a simple system of suction at the proper places and, although they require a fair amount of power to operate, they do not increase the difficulties or labour of operation. If the housekeeping problem is taken into account, they prove economical from the labour point of view alone.

While all elevators have had dust collection systems, they are mostly for the collection of dust from the cleaning machines only. Such systems cannot be called complete. The cost of a complete dust control system as installed and the continuing operating cost, mainly in power consumption, has been in the past a troublesome factor due to owners or operators having to make such installations. At the present time such systems cost installed about $40,000 per million bushels of elevator capacity. Power consumption would vary depending on the type of elevator and the ratio between the capacity of the storage section and the working section of the plant. In the average terminal the power required is about 75 hp. per million bushels of capacity.

Such systems therefore, in the earlier days of terminal elevator construction, were considered an operating expense without any particular revenue producing value. However, in more recent years, this viewpoint has changed. When the explosion hazard, together with the improvement in working conditions, is taken into account there is no longer any doubt about the value of dust control in an elevator plant.

This does not mean that it is possible to install a perfect system to control and collect all the dust. Such a system would be uneconomic in cost. The practical systems now installed are the result of years of study of the problem to achieve the best results possible, consistent with a moderate capital and operating cost.

GAS TURBINES FOR NAVAL PURPOSES

Commander (E) C. M. HALL, R. N.
Department of the Engineer-in-Chief of the Fleet, England

The possible advantages of the gas turbine for naval propulsion have been realized by Britain's Admiralty for some time, and steps are being taken to develop machinery of this type, both for warships and coastal craft.

Gas turbine plant specially developed for naval use is likely to have the following advantages over steam turbine machinery:

(i) Probable reduction in weight and space for given horsepower, with eventually a gain in overall efficiency, allowing greater radius of action or more weight for weapons or armour.

(ii) Less time required for starting machinery from cold, so that ships in harbour can be ready for sea in a shorter time.

(iii) When satisfactorily developed, gas turbine machinery is likely to be less complicated and less vulnerable than steam machinery.

During World War II all the available facilities for research and development were necessarily devoted to the gas turbine for jet propulsion of aircraft as this was essential to Britain's defence programme, whereas a gas turbine for warships, although desirable, was not vital.

Another factor is that the development period required for marine engines of large horsepower is much greater than is required for aircraft units of light weight construction and short life.

The information gained in the development of jet propulsion engines has been made available by Britain's Ministry of Supply to the Admiralty, who have taken steps to interest firms, other than those engaged in the aircraft field. By agreement with the Ministry of Supply, those firms which have carried out the aircraft development are forming marine wings.

Life of Machinery

Gas turbine and jet engines developed for aircraft have a life of 300-500 hours, whereas the life required for naval machinery is measured in thousands of hours.

The reversing problem has to be solved. Due to high temperatures involved, the normal astern turbine cannot be used; variable pitch propellers, electric drive and hydraulic reversing are possible solutions.

Gas turbines for aircraft use Kerosene fuel, and it may be some time before a satisfactory technique can be developed for burning heavy fuel of the type normally used for ships.

The Admiralty has the following development work in hand at the moment:

(a) Development of gas turbine machinery suitable for an escort vessel.

(b) Development of gas turbine machinery suitable for coastal craft in which an aircraft jet propulsion unit is incorporated.

Further high-powered, long life units are to be developed by well-known aircraft and land firms and by the association of thirty marine firms known as Parsons and Marine Engineering Turbine Research and development Association (P.A.M.E.T.R.A.D.A.)

In these developments, close co-operation with the National Gas Turbine Research Establishment has been established.

It is emphasized that marine gas turbines present problems which are not encountered in aircraft practice, and that, generally speaking, aircraft units are not suitable and cannot be adapted for marine purposes. Marine designs must therefore be started *ab initio*, and a very great deal of development will be required.

ELASTIC CONSTANTS BY SIMPSON'S RULE FOR AREAS

C. W. DEANS, M.E.I.C.
Estimator, Western Bridge and Steel Fabricators Limited, Vancouver, B.C.

There is a growing interest in the use of structures for buildings and bridges which have framed continuity through connecting joints. Very pleasing appearance and more correct structural functioning of material may be achieved by continuity of framing through joints connecting adjacent members. In order that such structures may be built in greater abundance in the future, it is necessary that structural designers acquire facility and speed in design methods. The problems in this type of work deal with members of non-uniform moment of inertia with greater strength near the joints and lesser strength near the mid-points of the members. This article will deal with efficient methods of determining the elastic properties of such members and will show that the device of Simpson's Rule for areas is of great help in this case. The simplified theory shown in Fig. 1 and the sample design sheet, Fig. 2, will serve to illustrate the determination of elastic properties of members of non-uniform and also of uniform moments of inertia. Since the most useful method available for structural designers in steel and reinforced-concrete structures is the moment distribution method of Hardy Cross (University of Illinois) the factors determined will be as follows: rotational stiffness, moment carryover factors, fixed-end moments, side-sway moments for fixed ends.

The method of areas of M/I and moments of M/I diagrams called the "Moment Area" method is used throughout as being fundamental. The coefficients C_1, C_2, C_3, C_4 as well as ϕM_s and $\triangle M_s$ are merely areas of the moment curves for conditions where the ends are free to rotate. Deflection and rotation equations for the ends of the members serve to provide us

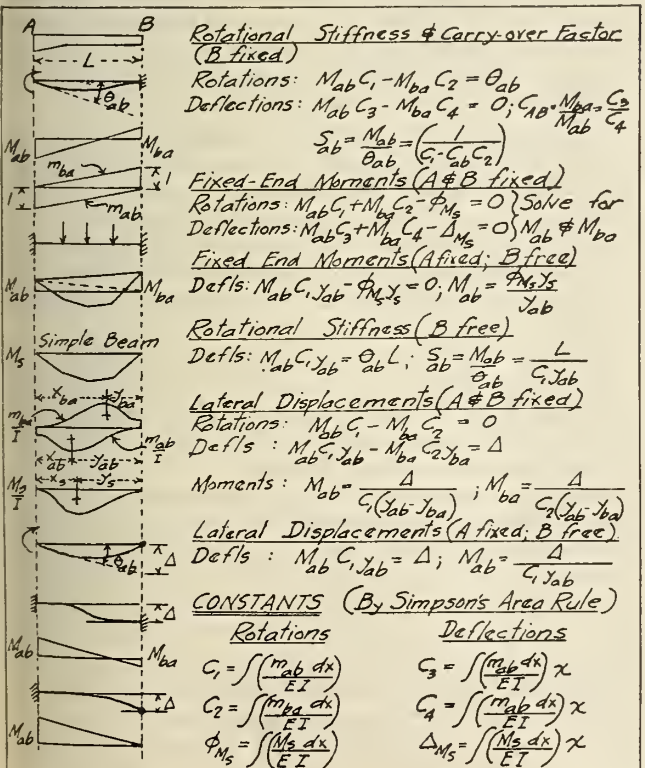
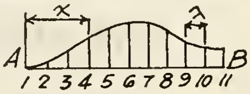


Figure 1.

TABULATION FOR ELASTIC CONSTANTS

Simpson's Area Rule:

$$\text{Area} = \frac{\lambda}{3}\left[\left(\begin{matrix}\text{End}\\ \text{Ords}\end{matrix}\right) + 4\sum\begin{matrix}\text{Even}\\ \text{Ords}\end{matrix} + 2\sum\begin{matrix}\text{Odd}\\ \text{Ords}\end{matrix}\right]$$



1	2	3	4	5	6	7	8	9	10	11	12	13	14
Ord.	$\times\frac{L}{10}$ x	m_{ab}	m_{ba}	$m_{ab}x$	$m_{ba}x$	$\times M_{max}$ M_s	$\times I_o$ I	$\frac{m_{ab}}{I}$	$\frac{m_{ba}}{I}$	$\frac{m_{ab}x}{I}$	$\frac{m_{ba}x}{I}$	$\frac{M_s}{I}$	$\frac{M_s x}{I}$
1	0	1.0	0	0	0								
2	1	.9	.1	.9	.1								
3	2	.8	.2	1.6	.4								
4	3	.7	.3	2.1	.9								
5	4	.6	.4	2.4	1.6								
6	5	.5	.5	2.5	2.5								
7	6	.4	.6	2.4	3.6								
8	7	.3	.7	2.1	4.9								
9	8	.2	.8	1.6	6.4								
10	9	.1	.9	.9	8.1								
11	10	0	1.0	0	10.0								
				Σ Even									
				Σ Odd									
				4Σ Even									
				2Σ Odd									
				Ords 1+11									
				Totals									
(I) Mult. $\frac{1}{I}$ by 3 to 7 to get 9 to 13								C_1	C_2	C_3	C_4	θ_{M_s}	Δ_{M_s}

(II) Mult 2 by 13 to get 14

$$y_{ab} = L - \left(\frac{C_3}{C_1}\right)\frac{L}{10};\quad y_{ba} = L - \left(\frac{C_4}{C_2}\right)\frac{L}{10};\quad y_s = L - \left(\frac{\Delta_{M_s}}{\theta_{M_s}}\right)\frac{L}{10}.$$

Figure 2.

with the values or elastic properties of members of non-uniform moment of inertia.

The arrangement of columns in the tabulation shown is very important because, with one setting of the slide rule for each line, the figures in rows 9 to 13 can be determined directly from those in rows 3 to 7. The figures in rows 2 to 6 are universal constants written down by inspection from the diagrams of M_{ab} and M_{ba} curves and the abscissa x from one end.

If the member is symmetrical then only one table is necessary but if it is unsymmetrical then another table must be calculated, reversing the position of the moment of inertia (I) ordinates in the table and then the only new figures which appear are due to the unsymmetrical distribution of values in column or row 6 for $M_{ba}x$.

An additional device should also be mentioned concerning M_s and I in rows 7 and 8. Here we select a maximum or convenient mean value of either M_s or I and call that unity for entry into the table. This device keeps all figures very small throughout the table and most of the calculations are done almost by inspection.

In rows 9 to 14 the coefficients C_1, C_2, C_3, C_4 and ϕM_s and $\triangle M_s$ are found by the tabulation of areas according to Simpson's rule for areas by dividing up any curve diagram into ten equal divisions with eleven ordinates counting the end ones. The formula is derived assuming that the curve between the tops of odd-numbered ordinates is a "square-parabola" so that the whole area is made up of a series of trapezoids and small parabolas. This Simpson-area device is very accurate and obviates the necessity of scaling mean ordinates for each division and using abscissae to the midpoint of each division which is really a waste of time.

There are other alternate methods for the determination of fixed-end moments and these are the elastic-centre method and the column-analogy method of Hardy-Cross but the moment of inertia and area calculations are centre of gravity calculations for these areas are more laborious than the ones indicated in this article using the Simpson-area device.

It is hoped that this above method will appeal to all designers and investigators of members of variable moment of inertia in the field of structural engineering and aeroplane design and in other fields where analogous methods to the moment distribution method of analysis can be used.

ENLARGED FIELD PROGRAMME FOR MINES AND GEOLOGY BRANCH, OTTAWA

A Condensation of an Announcement by the Minister of Mines and Resources, Ottawa

Mines and Resources Minister, the Honourable J. A. Glen, has announced that the Mines and Geology Branch of his Department is assigning a total of 90 geological, topographical, and National Museum parties to field work throughout Canada this year. It had been the intention to send out a larger number of parties, but extreme difficulty has been encountered in recruiting qualified men. As a result the permanent staff is the smallest it has been for fifty years past; most of the field parties are in charge of University professors and graduate students. In addition, twenty officers of the Bureau of Mines will visit quarries, mines, mills, smelters and mineral-using industries across Canada with a view to assessing current development and progress, and maintaining that close liaison with industry upon which the usefulness of the Department so largely depends.

The work of these field parties aids the efficient use and development of the country's natural resources and their conservation. The Topographical parties will map areas at the request of the Geological Survey, the Forestry Branch, the Departments of Agriculture and National Defence, and of various Provincial Departments. The purpose is to aid the discovery and development of minerals, and to determine underground water supply in the Prairie Provinces and certain parts of Ontario. The National Museum's interests cover the natural flora and fauna, including its human inhabitants.

Projects costing a total of \$9 millions will be undertaken on behalf of the mineral industry in the Northwest Territories. Eleven parties will cover the area this summer. Radioactive mineral areas on Camsell River and Great Bear Lake will be mapped, while gold bearing areas around Lac de Gras, Indin Lake and Yellowknife will be mapped and studied, and coal seams examined around Pond Inlet and on Baffin Island.

Nine parties will do mapping in the Yukon. Geological mapping will be done around Whitehorse, Dezadeash and McQuesten, while topographic maps will be made along the Alaska Highway, and between the Lewis and Pelly rivers, for the Geological Survey.

Some fourteen parties will cover British Columbia under direction of W. F. Cockfield of the Vancouver office. Three parties will do topography along the Alaska Highway, a fourth around Whitesail, south of Smithers. Coal fields on Vancouver Island will be studied by another party, while seven more parties will do geological mapping of areas around Salmon Arm, Aiken Lake, the Columbia River Basin, Whitesail, Nelson and Zeballos. Two more parties will locate the boundaries between Cambrian and Pre-cambrian rocks in Southern B.C.

In Alberta, two topographic mapping parties will prepare for geological and agricultural surveys. Two parties will map geologically in the northern foothills where oil structures and coal seams are being tested. Another two parties will cover southern foothill areas with geological maps where potential oil structures are being tested. Stratigraphic studies to aid in search for oil, gas and coal, as well as a study of cores and cuttings from wells, will be conducted. Another party will investigate ground water supplies and a party will continue studies of palaeontology.

In Saskatchewan three parties will make topographic surveys for forestry and geological purposes. Geological mapping will be started west of Flin Flon and continued in the radioactive area around Lake Athabasca, by two more parties. Oil well cores and cuttings will be studied.

In Manitoba three topographic survey parties will be out in the Swan River, Riding Mountain and Lake Winnipeg areas for forestry purposes. Four geological mapping parties will cover gold areas around Crowduck Bay and east of Herb Lake and Snow Lake, and base metal areas on Kississing River and Nokomis Lake. Another party will investigate ground water supplies south-west of Souris.

In Ontario, two parties will co-operate with the Ontario Department of Mines on topographic and geological mapping of the gold belt north of Kirkland Lake; another party will map Manitoulin Island, stratigraphic studies will be made in the oil and gas areas of southwest Ontario and ground water will be investigated around Lake Simcoe.

In Quebec, two topographical mapping parties will operate in the Matapedia valley and west of Lake St. John on behalf of agriculture, and a third in Ungava will carry out triangulation. Geological mapping will be conducted in Ungava, in the eastern end of the Quebec gold belt, in Beauchastel and Dasserat townships, and in the Eastern Townships by five more parties.

In the Maritimes, four topographical parties will map in New Brunswick and a fifth will do geological mapping west of Saint John. In Nova Scotia, four parties will do topography and two more will make geological maps in Cape Breton.

Work on behalf of the National Museum has been greatly curtailed due to depletion of staff. Two botanical parties will cover the James Bay area and the reindeer reserves in the Mackenzie Valley. A biological party will work in Ungava; two archaeological studies will be conducted, one in the St. Lawrence Valley where Indian settlements will be flooded by the St. Lawrence Seaway, the other west of Renfrew at Golden Lake; folklore studies will be continued in Quebec and Nova Scotia; and ethnological studies will be continued among the Indians of the Pacific Coast.

From Month to Month

News of the Institute and other Societies, Comments and Correspondence, Elections and Transfers

IF YOU WANT MORE INFORMATION

Elsewhere in this issue of the *Journal*, as part of the minutes of Council, is printed a report of the Committee on Professional Interests dealing with the Canadian Council of Engineers and Scientists, which was presented to the Council of the Institute on June 21st. The report is the outcome of discussions held at the annual meeting of Council in May. To any members who are interested in getting a fuller picture of the situation it is recommended that the report be perused and the references examined.

Frequently members have complained that the Institute has been criticized for its refusal to join the new council, and that they have not been informed sufficiently of the reasons back of Council's decision so that they could intelligently enter the discussion.

Council has been reticent to criticize another organization before its members and has refrained as long as possible from such action. Only the persistent appearance of erroneous, incomplete and misleading material critical of the Institute, originating elsewhere, and the request from members for information on the subject, made it necessary to take part in the distribution of information on this controversial subject.

The Committee on Professional Interests accepts responsibility for any criticism of the Institute's failure to keep its members properly informed. However, they have placed the general facts before the members in a dignified manner and in what should be adequate quantities. Unfortunately members do not read everything in the *Journal* or else they forget. There have been many references to the subject in this publication as the report shows, and yet at the annual meeting some members said they could find little or nothing. In addition to what has been published in the *Journal* the entire membership was circularized by direct mail in January of this year.

If you want to inform yourself on the reasons back of Council's policy please look up these references in *The Engineering Journal:*

June 1945—Page 391 " Report to the Membership from the Committee on Professional Interests."

June 1945—Pages 399-400 Minutes of Council Meeting " Reports from the Committee on Professional Interests."

August 1946—Pages 488-489 " The Institute Policy towards New Council of Engineers and Scientists."

June 1947—Pages 278 & 290-292 Discussions at Annual General Meeting and Annual Council Meeting—May 1947.

In addition to the above the entire membership was circularized by direct mail in January 1947.

With this information in mind every member will better understand the various pieces of propaganda that are brought to his attention, and will be able to dispel most, if not all, the adverse statements that may be offered him.

Please read the report on page 343 under the heading " Committee on Professional Interests ".

MORE ABOUT ENGINEERS AND ARCHITECTS

The denial by the Court of King's Bench of the appeal of Brian R. Perry from the decision of the Superior Court in the case of the Province of Quebec Association of Architects versus Perry was reported in the June *Journal*. Therein it was stated that a detailed account would be prepared for this issue.

It is difficult to know how far to go in commenting or reporting on the decisions. It is not easy to refrain from criticism of the Courts as well as the architects. The engineer who follows the evidence and applies the factual thinking for which he has been trained may well wonder at the outcome, but unfortunately not many engineers will see the evidence. Hence, some comment, restrained though it must be, may be useful.

In the beginning it was thought the suit would be regarded as a test case, and that the decision would be far reaching. In fact, the trial judge had ruled that no engineer could design a " similar " building without giving offense under the Architects' Act. Therefore, the Corporation of Professional Engineers of Quebec and The Engineering Institute took a special interest in it. However, it is now disclosed in the notes of the appeal judges that absolutely nothing has been gained or settled. No principles or practices have been established. It has been a useless dispute over a single building that cannot apply anywhere else. For instance one judge states " Each particular controversy between engineers and architects must be treated on the merits of that particular controversy and as it is in this case, and will be in others, each must be decided on the facts at issue in each case ", and another states " Each case must, therefore, be evaluated upon its special facts particularly when the statutes, under which the conflicting privileges under consideration are put forward, approach so closely the one to the other, and leave imperfectly defined the precise line of demarcation at which the field of operation of the one avocation terminates and the other begins. Many cases must fall close to the line, in that nebulous and shadowy region where the opposing exclusive rights approach one another actually meet, and become merged; the area in which there exists, in a sense, a species of legal no man's land, to be occupied by one or the other of the competing groups at his or its peril.

" Until the legislature has made the differentiation more definite and laid down the precise limits within which the Architect and the Engineer are to exercise their cognate functions, the Court may only endeavour, as best it may, to apply the existing statutes to the special facts submitted in a given case with a view to bringing about a reconciliation of the adverse claims. The closer the particular case approaches the line, the more palpable the difficulty becomes."

The architects have gained nothing nor have the engineers lost anything, except that between them they have spent about $15,000.00. It has been a useless, stupid and shameful exhibition. As the *Engineering News Record* says it has been " a jurisdictional dispute that should cause all reputable architects to blush with shame."

At no time was the public interest considered. It was admitted on all sides that Mr. Perry was competent to do the work and in fact had done an excellent job. It was simply a question of who had the legal right to do it. It was for all the world just like a jurisdictional dispute between two trade unions—of which we have all seen too much.

Engineers are not going to discontinue to design buildings, nor are they going to do the work over the name of an architect. Public safety requires that they continue to do in their own names what they have always done up to now. The experience gained in this case is not likely to encourage architects any place in Canada to follow the Quebec example—particularly if they study the evidence and the judgments.

The Record

In re-examining all the documents as a preparation for making this report, it appears as if the factual information was pretty well presented in the *Journal* of February, 1945, pages 99 to 103. It is recommended that interested members refer to that issue. The shortage of paper as well as reading time makes it inadvisable to reprint or restate the original case in this issue. However, no account has been given as yet of the appeal itself. Herewith is comment and information which, along with the February 1945 report, will round out the picture fairly well.

The appeal came before the Court of King's Bench on January 20th and 21st, 1947 and judgment was handed down on April 26th, 1947. Five judges constitute the Court but in this case one judge was called from a lower court to round out the panel. It so happened that the lower court from which the fifth judge came was the one in which the case had been heard in the first instance, and the judge whose decision was being appealed had since been made the Chief Justice of that court.

The Architect's Competence

One judge states, " There is ample evidence (pointed to in the notes of my colleagues) to support the view that an architect was, or considered himself to be, capable of carrying out the main line of the enterprise, the designing of a building, subject to the employment of such particular and technical skill as might be required."

This is an admission that the architect is not competent to do the entire work, and at the same time is a clear indication that the engineer is the only one who is. And yet the same judge decided the building was not an engineering work. This is one with the statement made by the original trial judge when he said the word " works " as mentioned in the Engineers' Act did not embrace buildings, although he referred to the Oxford dictionary where " work " is defined as follows:

" WORK (Noun) (With Possessive) A thing made; a manufactured article or object; a structure or apparatus of some kind. An architectural or engineering structure; a building, edifice. Architectural or engineering operations.

A fortified building; a defensive structure.

An excavation in the earth, made for the purpose of obtaining metals or minerals; a mine.

An establishment where some industrial labour, especially manufacture is carried on, including the whole of the buildings and machinery used."

The Appeal Court makes much of the architects' testimony at the first trial (offered without example to prove it) that they were competent to design the entire building under discussion; this evidence being offered to prove that it was not an engineering work. It was pointed out in the Appellant's Factum (Appeal) that, " Mr. Harrington testified that he employed an architect for the first building and that it suffered from these defects. Vibration was so serious that changes were required even to maintain bearable conditions in the office, and precision machines housed in the building even after the changes did not operate satisfactory and a lot of rejections for faulty work resulted." This testimony was not referred to by any judge in the appeal notes.

Another extract from the Appellant's Factum, referring to the architects' endeavour to prove their competency, is this: " One of the witnesses called by the Respondent was Mr. Payne, an architect who testified that he was the architect who built the Sun Life Building in Montreal, also the power house on the east side of Mansfield Street, of which he appeared to be very proud. However, in cross examination, Mr. Payne admitted that he called in engineers for every part of the building except the finishing. He admitted that the power house was designed by engineers, and of the main building the structural, the foundation, the roof, the elevators, the heating, the plumbing and when he was asked what was left for the architect he replied the finishing."

This evidence, too, seemed to have escaped the attention of the Court for no mention is made of it by any judge, but on the contrary one set of notes says, " I consider the plaintiff Association has clearly established that there are many architects who have the skill, qualifications and experience required to do what the defendant did."

Engineering Data

It is interesting to review the volume and the nature of the work which the engineer had to do before he could even start the design of the building. The evidence shows that he had to study the design and work to be done by the machinery to be housed. He had to follow the product to the premises of the consumer in order to know what work it had to do after it left the plant. He had to work out the most efficient flow of materials through the plant and determine all the special treatments that were required at various stages. Only after he had such information could he start his preliminary design.

The architects, on being examined, claimed they could design the building, but they were never asked by the Court if they could lay out the machinery or design the special features required for special treatment. The architects said they expect to get such preliminary information from the owner; the owner, in this case, admitting that he didn't know—that was why he had engaged an engineer. It was as if an architect had stated that he could design a hydro power house—providing somebody gave him all the information about foundation conditions, loadings, vibration, location, dimensions and weight of turbines and generators, etc., etc., etc. One is reminded of the small boy's remark—" If we had some ham, we could have some ham and eggs, if we had some eggs."

Irrelevant

Incidentally, all this argument about the architects' ability had nothing whatever to do with the case, although the judges refer to it frequently to support their decisions. The issue was simply to determine if what Mr. Perry did was an engineering " work " as described in the Engineers' Act. The best authority in the world on the meaning of English words—the Oxford Dictionary—as quoted previously, proves clearly the correctness of the engineers' contention that it was an engineering work.

For the Future

The joint committee of the Institute and the Corporation of Professional Engineers of Quebec have recommended that further appeal be abandoned. In fact, the date before which notice of appeal had to be filed is now past and there is nothing more that can be done. It is hard to abandon a case when you know you are right, but if you can't make the Court see it you might just as well give up and save your money and your breath. After all, it now transpires that this decision means nothing, and in no way ties the hand of the engineer in this or any other field.

One can be pardoned if at this point he recalls the words of Mr. Bumble, " The law is a ass ".

NEW LEGISLATION FOR COLLECTIVE BARGAINING

Bill 338, dated June 17th, 1947, is the new Industrial Relations and Disputes Investigation Act, replacing the now famous Order-in-Council 1003. It was this latter order that caused all the stir in engineering circles relative to collective bargaining.

As the Institute has a Committee on Employment Conditions, the *Journal* does not propose to make any extensive comment until the committee has made its report. The Bill was presented in the House by the Minister of Labour on Tuesday, June 17th, which did not leave time for the committee to complete its study before the printing of this issue of the *Journal*.

A preliminary draft of the Bill was in the committee's hands some time ago, and observations were sent then by the committee to the Minister. The Bill in its present form has substantial changes compared to the preliminary draft and may have more before it gets through the House—if it does. From the professional worker's point of view the significant parts of the Bill are as follows:

2 (i) " employee " means a person employed to do skilled or unskilled manual, clerical or technical work but does not include:

(i) a manager or superintendent, or ony other person who, in the opinion of the Board, exercises management functions or is employed in a confidential capacity in matters relating to labour relations;

(ii) a member of the medical, dental, architectural or legal profession qualified to practise under the laws of a province and employed in that capacity:

Section (i) gives a new limitation to " confidential capacity ". This capacity now is restricted to " matters relating to labour relations ". Previously the term might have meant anything but now it is surely prescribed in such a way that not many employees can seek exemption under it.

Section (ii) is indeed an innovation. The medical, dental, architectural and legal professions are excluded beyond any doubt, but by the same token the engineers are included, beyond any doubt.

In the old Order the professions were not enumerated or separated, for the simple reason that it was not intended that the legislation should apply to the professions. The present precise exemption of certain professional groups is granted because they emphatically and persistently demanded it.

The Bill applies only to those employed by firms operating a business of a national or inter-provincial character—generally speaking communications and transport. It remains to be seen if the provinces will adopt the same or similar terms. As 1003 was adopted by several provinces for all industry, it is reasonable to assume that 338 will be accepted as the provincial legislation by at least some provinces.

Bill 338 may become of greater importance to engineers than was 1003. Only time will tell. It is expected that the next issue of the *Journal* will contain the committee's report to Council.

CANADIANS AT AMERICAN UNIVERSITIES

Some time ago the Institute received a letter from a group of Canadians taking graduate training at the University of Wisconsin in which they protested employment conditions in Canada. The letter has not been referred to in the *Journal* previously as it was hoped additional information could be obtained, and certain points clarified by an exchange of letters with the students. This exchange has now taken place and discloses that none of the students are engineers. To some extent this lessens the application of the information to the engineer's position, but there are still some interesting points that could be studied with profit by the engineers and their employers.

In the first place the letter states there are 57 Canadians there, 50 of them on scholarships of the university, with a minimum value of $1000 each. A contribution of $50,000 a year to the education of Canadians is more than a trifling matter, and when consideration is given to the fact that many other universities offer the same opportunities, we can see one of the reasons for graduates of Canadian universities going to the United States.

This group of Canadians have organized themselves to study the why and wherefore of their presence in the United States. A questionnaire has been circulated and 35 replies received. The questionnaire disclosed the following information in response to these questions.

Were you employed in Canada before coming to the United States?

Yes, 22 No, 13

Were you satisfied with the working conditions?

Yes, 18 No, 4

Were you satisfied with the salary?

Yes, 4 No, 16 Doubtful, 2

Would you prefer to work in Canada under present conditions?

Yes, 8 No, 19 Doubtful, 6

If salaries were comparable would you return to Canada?

Yes, 30 No, 0 Doubtful, 3

What salary would you earn if you remained here? $3800 average.

What salary would you earn if you returned to Canada? $2800 average.

The students come from the following provinces: British Columbia, 5; Alberta, 10; Manitoba, 3; Ontario, 9; Quebec, 4; New Brunswick, 1; Nova Scotia, 1.

Of the 57 the largest number, 14, are taking biochemistry; 6 are enrolled in each of bacteriology, agronomy, and chemistry. The others are divided between zoology, genetics, German, soils, geology, entomology, botany, sociology, economics, cancer research, history and mathematics. About 90 per cent are proceeding to a Ph.D. degree. There is little relationship to engineering, but still the material is interesting in that figures for engineers would probably run about the same.

One cannot refrain from commenting on the statement that salaries in Canada for Ph.D.'s would be only $2800. The students must have had in mind, employment with the government or perhaps a university. Certainly industry in Canada would pay much better than that, even up to the $3800 which it is said they would get in the States.

It is too bad that this substantial group should make appraisals of their earning power in Canada based on the government scale of wages. If they see only this narrow field for themselves they may well give no consideration to returning here. Unfortunately the penurious salary set-up of the civil service is too well known, whereas the better wages of industry seem not to be so well advertised. Can anything be done to inform university students that they do not have to work for the government, and that in other fields there are good livings to be obtained, that compare favourably with conditions in the States?

In answer to the question, "If salaries were comparable would you return to Canada?" there was not one negative reply out of 33 responses. Thirty stated clearly that they would return. True, this is but a small group but still their responses should be valuable, as they are informative. These young men want to work in Canada. What can Canadian employers do to encourage them to return?

PRESIDENTIAL VISIT TO THE NIAGARA PENINSULA BRANCH

On the evening of Friday, June 13th, the Club Henley at St. Catharines, Ont., was the scene of an important meeting of the Niagara Peninsula Branch. The occasion was the commencement of the annual branch visits by the President of the Institute.

President Grant, accompanied by Douglas Laird, the new assistant general secretary, was greeted at St. Catharines by members of the branch executive including the chairman M. F. Ker, the retiring chairman W. D. Brownlee, secretary-treasurer "Pete" Pasquet, councillor Paul E. Buss and the vice-president for the division, W. R. Manock. At the Club Henley, preliminary refreshment was provided according to an old and proved branch recipe, while the sixty-odd members made the acquaintance of the new president and assistant secretary.

Left to right: Councillor Paul Buss, Thorold; L. C. McMurtry, Fort Erie; (unidentified); President Grant; L. P. Rundle, St. Catharines.

Following the excellent dinner, the chair was relinquished by Mr. Brownlee to the incoming chairman who paid tribute to the efforts of his predecessor and other retiring members of the branch executive. Mr. Laird was asked to say a few words and he supplied some indication of the reasons for the undernourished condition and publication delays of *The Engineering Journal* and asked for assistance in the form of letters to headquarters to indicate the trends which should be followed in the policies of the *Journal.*

The President's address.

The president said that one of the most important questions facing the Ontario members of the Institute was more cooperation between the Institute and the Association of Professional Engineers. He urged them as members of the E.I.C. to lose no opportunity of supporting the Association, and hoped that as members of the Association they would correspondingly support the E.I.C., since the two organizations are supplementary to each other.

On Saturday morning councillor Paul Buss drove the president and Mr. Laird to Niagara Falls via a portion of the Welland Canal. At Niagara, the president left for Toronto, proceeding to Chicago, where he was to represent the Institute at the Annual Spring Meeting of the A.S.M.E. It is a tribute to the E.I.C. that, as a result of observation of the conference of Student delegates at the Institute's recent annual meeting by A.S.M.E. officials, President Grant was drafted to serve on a newly formed educational committee of the A.S.M.E.

Mr. Laird remained in Niagara Falls where he was most generously entertained until the evening train by Secretary-treasurer P. A. Pasquet and Mrs. Pasquet.

BRANCH OFFICERS MEET

One of the most interesting of the many "side shows" which took place during the course of the recent annual meeting at Toronto was a conference of chairmen and secretary-treasurers of branches. This was held on the evening of Thursday, May the 8th in one of the private dining rooms. The meeting opened with dinner and the discussion followed immediately after.

There were 28 persons present representing 18 branches from points as far as Halifax, N.S., and Edmonton, Alta. C. E. Sisson, retiring vice-president for Ontario, presided.

The agenda covered a multitude of details of branch and Headquarters activities and each item was discussed fully. It was explained that the purposes of the conference were twofold. First, to discuss the means by which Headquarters could be of more assistance to the branch officers and second, to discuss means by which the branch officers could give additional assistance to Headquarters.

Several constructive suggestions were made as to changes in Headquarters and branch routine that would produce better results. These included the treatment of such things as applications for admission, transfers, resignations, change of address, obituaries, branch financing, branch records, and the recruiting of new members. Also, means of finding papers, speakers, and films for meetings, and news of branches as reported for the *Journal*.

Considerable time was devoted to a discussion of what certain branches could do to be of additional service to the students attending universities in their cities, and also to assist junior engineers. This discussion disclosed that many branches were interested in the prospects of establishing student sections, and others of establishing student sections in the univerities. It was also disclosed that the American Society of Mechanical Engineers and the Institute have just set up a joint group to study ways and means whereby the service to the student and the young engineers in Canada could be improved by joint action between these two organizations.

Another important item on the agenda was a discussion of the possibility of Council paying all or some portion of the travelling expenses of councillors coming to meetings of that body. It was seen that in spite of the increase in revenue from the new fees, it would be an impossibility to pay all expenses to all meetings, but certain suggestions were made and the subject was left with the officers of the Institute for further consideration.

Before the meeting adjourned it was agreed that a similar conference should be made the feature of every annual meeting programme and that instead of devoting three or four hours to it, a full day should be made available. This proposal was passed on as a recommendation to the incoming Council.

AN AMBITIOUS PROGRAMME FOR COMMUNITY PLANNING

At the May meeting of Council the Committee on Community Planning made a report of more than usual interest and significance. No one can accuse the committee of under-estimating the size and importance of the task placed before it.

It is doubtful if there are many subjects in the public mind these days that are of more far reaching significance than community planning, and yet we seem to be getting nowhere. There is so much unsound thinking, so much petty politics, so much personal interest, so much ignorance, that one group seems to nullify the other, with the result that no improvement in conditions appears anywhere.

The mails are flooded with proposals on paper, from the States, England and Canada. In some instances these are advertising propaganda for specialized interests. In others they are the work of volunteer lay groups who have consulted technical experts, but they do not represent work actually in progress. Mostly they are still only dreams.

The Institute's committee proposes that the Institute should do something about it — something about the public apathy, something about sane technical data and procedure—something about providing leadership where it is wanted badly. No one can find fault with the comments and conclusions of this report. There may be room for argument as to whether the Institute can carry such a burden, but there is no argument about its common sense factual analysis of the problem.

Council approved the report and asked the committee to continue its study, with the ultimate objective in mind that the whole matter would be the basis of the programme for the special conference in community planning authorized by Council several months ago, to take place in Toronto next November.

Herewith is the committee's interim report:

Preamble

1. Community Planning has been a failure to date in that it has not demonstrated its effectiveness to correct the social sores of modern civilization.
   Community Planning consists of far more than the drawing of maps and devising intricate patterns of streets. It involves the study of the *fundamental* causes of residential and commercial slums, and the development of reasonable corrective measures to arrest the decay and to transform back to a good condition the deteriorated properties It involves the education and training of those who will be actively in charge of planning and the enlightenment of the general public in the fundamentals of community planning and in good practical expression of those fundamentals in the design and conduct of communities.
2. This Panel believes that to obtain full benefit to our country in general and to the individual communities, the Institute as a whole must be the responsible leader in Community Planning so that the whole weight of the Engineering Profession may be thrown into the balance, rather than the windmill tilting of an individual engineer or engineering firm.
3. The council must be impressed with the opportunity that exists now to plan for better living conditions in our communities, and must encourage and support those engineers who have made community planning a part of their practice. A unanimous council should initiate and carry through a programme to rouse the public to appreciate the truth and the reliability of the engineer's approach to the problem, to provide the leadership, and to father the social legislation necessary to support the individual members engaged in promulgating good planning.
4. The council must also initiate and carry through a programme of education of its members and its coming members in the *fundamentals* and the technique of Community Planning. To this end the composition and distribution of a manual of Community Planning for Canada is imperative and should be undertaken at once. Collaboration with the universities for the inclusion of Community Planning in their curriculae is also essential. And the creation of a position of travelling director of the Institute's programme of Community Planning is very necessary to follow up the material published in the *Journal* and matter sent by mail.

In general this panel suggests the following as some of the fundamentals referred to in Clause No. 4 to be recognized and treated.

(a) The process of municipal assessment — how it must be re-arranged to help correct existing deterioration, prevent the creation of new future slum or depressed areas, and to obtain a proper physical structure. The present system results in distorted and undesirable development. automatically resulting in depressed areas.

(b) The process of municipal government—Councillors should be supplied with educational matter that will head off errors of omission and commission, often encouraged and supported by hired " experts " and in many instances honestly, but ignorantly, promoted.

(c) The maintenance of civil liberties and sovereign rights of the individual, proper police powers for the community and the institution of an as near as possible ideal municipal government, are definitely important considerations of Community Planning.

(d) That the school system must be designed and maintained to fit the neighbourhood with due emphasis on the value of the system to the child.

(e) That much bad planning has taken place since the earliest days of the settlement of Canada and the bad effects must be emphatically pointed out so that repetition of the mistakes will be avoided.

(f) That the densities of population in certain types of communities should be kept within definable limits to make sure that the residents have reasonably good healthy accommodation and yet the municipal services to them are not extravagant and over-extended.

(g) The methods of municipal financing should be studied and improved.

(h) Review the aims of post-war reconstruction.

(i) The engineering profession has a definite obligation to society that should be recognized and met.

PUBLICITY FOR THE ENGINEER

Believing that publicity for the annual meeting is good for the whole profession as well as for the Institute, it is part of Headquarters' policy to arrange that suitable material be readily available to the press. When news and comment is printed on a national basis it is difficult to know how much coverage is secured, but a reasonably accurate account can be made by a process of press clipping. It is from such a source that the information contained in the following report was received. It is not complete, but it is informative.

This report was prepared by the general secretary and presented to Council at the June meeting and is being published herewith under instruction of Council so that members may have some idea of how widespread is the news of the Institute. The details were supplied by R. C. Purser, M.E.I.C., of Ottawa, who has handled the annual meeting publicity for many years.

Report to Council

Because of the difficulty of a person in any one city appreciating the widespread publicity which develops from an annual meeting, I would like to bring to the attention of Council some interesting and impressive facts.

From time to time we receive suggestions that the Institute does not get enough publicity. Sometimes the suggestions include proposals as to how more can be secured, but actually it is difficult to know how much we do get, except in the case of this annual survey which is made for us by Mr. Purser. It is my opinion that the annual meeting of the Institute gets as much newspaper notice as a meeting of any other organization in Canada, with the possible exception of the medical profession.

First of all, news accounts relating to the annual meeting appeared in 86 different newspapers, running all the way from Halifax and Cape Breton to Victoria and Nanaimo.

The total amount of publicity was 2,173 inches. This refers to material one column in width. Last year's publicity amounted to 1,204 inches.

By provinces the publicity was distributed as follows:

Ontario .... 1,144 ins.
(145½ inches of this being in Toronto papers)

Quebec	225 ins.	Manitoba	77 "
New Brunswick .	157 "	Saskatchewan ..	97 "
Nova Scotia	109 "	Alberta	123 "
P.E.I.	53½ "	British Columbia	187½ "

Considering the record by individual papers, we find that the *Hamilton Spectator* gave us 116½ inches of space, which is almost twice the amount given by the next paper, namely the *Saint John Times Globe*, 67½ inches. Six papers gave us more space than the *Toronto Globe and Mail* which gave us more space than any other Toronto paper. Incidentally the *Toronto Star* gave us only 19 inches, thus ranking about 60th on our list of 86 papers.

I emphasize the situation with regard to the Toronto papers because this year we made a special effort to develop the Toronto field. A special local committee on publicity was established in Toronto to handle the Toronto papers. Papers in Hamilton, Saint John, London, Cornwall, Sarnia and Windsor, all gave us more space than the *Toronto Globe and Mail;* and the *Montreal La Presse* was only an half inch shorter than the *Toronto Globe and Mail. The Montreal Star* stood 17th on the list, and the *Montreal Gazette* 22nd.

It is interesting to note that editorial comment was made in 12 different newspapers, including such cities as Toronto, Ottawa, London, Windsor, Sault Ste. Marie, Niagara Falls, Montreal (4 editorials in four different papers), Edmonton and Victoria.

There was also considerable space given to photographs of guests and officers of the Institute. For instance, three papers ran cuts of Air Commodore Whittle and Mrs. Whittle, two columns in width. One column cuts of officers of the Institute, guests and speakers, appeared 35 times.

In order to visualize what this amount of publicity means let me restate it this way: 2,174 inches of space is equivalent to more than 5 full pages of a standard eight column newspaper. This is a rather substantial performance. I think great credit is due Mr. Purser for his untiring effort on behalf of the Institute. We are indeed fortunate to have such a well qualified man, a Member of the Institute, who is prepared to do his bit for the organization in this way.

In addition to the newspapers referred to above, there were several references on the radio, including a broadcast in French by Whittle in Montreal and a broadcast of General McNaughton's luncheon address. Whittle's press conference in Montreal was reported widely across Canada but is not included in the summary.

In addition there will be more publicity through the monthly periodicals as we have been asked by several publications for permission to print papers and speeches.

HOMAGE TO THE SAPPER

The following editorial is reprinted in the *Journal* as a tribute to the sapper. It is quoted from *The Canadian Sapper,* the mouthpiece of the sapper himself, as represented by the group in training at Chilliwack, B.C., about which we have written before. (Ed.).

Three Years Ago—Operation Overlord

June 6th, 1944—" D-Day ", then and forever—the men of the First Canadian Army with their British and Allied brother-in-arms landed on the beaches of Normandy and left there, dead, two thousand and forty-eight of their number.

The first to die of that two thousand and forty-eight, a typical Canadian soldier from a typical Canadian Unit, was H-63145 Spr. A. H. Johnson of the 6th Fd Coy RCE. He fell in the swirling, wirestrewn water near the beach at Graye-sur-Mer as the enemy vainly tried to repel the relentless fury of the forces of " Overlord ".

A year to a day later the only soldiers visible on that scarred beach were the sappers who were left to clear the mines and other obstructions and to cut up the steel barges for scrap: and in a nearby field the sappers of a cemetery construction unit making a permanent resting place for their brothers who would never go home.

Those two June days, one in 1944 and one in 1945 illustrate just what it means to be a sapper. First on the beach, first to get ready for those who follow, first in sacrifice—then last to go home, last one to clear away the other chap's mess then last of the living to cherish the honored dead.

All honor to the men of ' Overlord ' and to the sacred remnants of our soil which were left on that beach: all honour to Death's first prize on that beach —a Canadian sapper: all honour to the humble toilers who were left to restore order in that scene of carnage: but honour above all to the spirit of Canadians exemplified in those extremes of circumstance on that beach—the spirit of men who fought on D-Day and after until the need of fighting was over and who then returned to the job of restoring a peaceful world.

One ' D-Day ' was enough. We need no ' next war ' in which to prove ourselves. Let all sappers, all soldiers, all men, concentrate on winning the permanent victories of peace and we need never again be faced with the task of winning the ephemeral victories of war.

RECOMMENDATIONS OF CANADIAN ENGINEERS TO BE CONSIDERED AT INTERNATIONAL CONFERENCE

Recommendations for the allocation of frequencies for radio broadcasting, radio communications and other services using high frequency radio and electronic equipment in Canada have been made to the Department of Transport by the Canadian Radio Technical Planning Board of which the Institute is a member.

The preliminary report, prepared by Panel " A " of the Board, may have far-reaching significance in establishing the orderly use of the airways by radio and other users of the frequency spectrum. Such users include radio broadcasting; frequency modulation systems; television; point-to-point radio communications (police, fire, forestry, railway, highway transport, marine, utilities, airlines and similar services); industrial, scientific and medical; radio aids to navigation; and many other services which are in use or are likely to be established in the public interest in the years ahead.

An emergency meeting of the Board was recently called in Ottawa to give final approval to the Panel " A " report in time for its submission to the Department of Transport before officials of the Department left to present Canada's recommendations at the International Radiocommunications Conference in Atlantic City.

The rapidly increasing development of new radio and electronic equipment and services during recent years has made it imperative that adequate space " on the air " be allocated to such services without delay, officials of the Board point out. The steps now being taken will, it is hoped, lead to the orderly use of the frequencies available, avoiding confusion and attendant delay in bringing the full benefits of the present and new developments to the Canadian public at large. These services are already important from the standpoint of education, entertainment, health and safety.

Since radio waves do not stop at international boundaries, the rights and requirements of all nations must be taken into account in any frequency allocation scheme and, obviously, there must be complete cooperation and agreement between these countries. It is expected, therefore, that, following the International Conference, the officials of the Department of Transport will refer the matter back to the Planning Board with whatever data it has obtained through the facilities of the Conference.

A complete and final recommendation will then be made to the Department after study by the one-hundred and eighty prominent engineers and scientists, who make up the working Panels and Committees of the Canadian Radio Technical Planning Board.

ENGINEERING AND MARINE EXHIBITION

The Engineering and Marine Exhibition which opens at Olympia, London, on August 28th to September 13th will present at least one interesting refutation of the carefully circulated story that British Industry—tied by crippling controls, shortages of raw material, man power and fuel—has neither the resilience nor the initiative to weather the international marketing storms.

Never in the long and successful history of this Exhibition have the organizers had to plan their space on such ample lines. This year's exhibition embraces the whole of the Main Hall and National Halls of Olympia together with their galleries, an increase of over 45 per cent on the 1937 Exhibition. Every available square foot of this space is taken; mostly by firms who for years have been regular supporters of this leading British Exhibition. Also represented are many newer industries whose advent is an index of the vast war-induced subdivision and specialization in the trades ancillary to Shipping and Engineering.

The organizers are to be congratulated upon the fact that Lt.-Col. Lord Dudley Gordon, D.S.O., has consented to become the President of the Exhibition this year.

THE ROYAL CANADIAN SCHOOL OF MILITARY ENGINEERING

Canada's Active Force Army will be composed of technically trained specialists capable of providing a sound framework in the event that greater mobilization is ever required.

Specialized training of the various " Corps," or " Arms " is caried out mainly at the " Royal Schools " established across Canada.

The following article on the Royal Canadian School of Military Engineering is designed to acquaint Canadians with the functioning of their new Army. It has been written specially for the *Journal.*

The Royal Canadian School of Military Engineering or R.C.S.M.E. situated near Chilliwack, B.C., is the outgrowth of the wartime unit officially known as A-6 Canadian Engineer Training Centre.

During the war years large numbers of " fighting Sappers " were trained at the two Engineer Training Centres, A-5 C.E.T.C. at Petawawa Ont. and at A-6 C.E.T.C. A-6 C.E.T.C., later to become the R.C.S.M.E. was formed at Dundurn, Sask. under command of Lt. Col. Murray Dillon, M.C. The climate and terrain at Dundurn, however, did not prove to be entirely suitable for engineer training so Lt. Col. (now Brigadier) Dillon and Maj. Gen. Howard Kennedy—the then Quarter Master General—sought and found what has turned out to be the almost ideal site of the present School.

The camp and training areas cover an area of about 700 acres along the Vedder River at a point where the swift Chilliwack River emerges from a mountainous valley to the floor of the Fraser Valley and has been diverted from its original channel to what is now the Vedder River and Canal. The fact that the Vedder is continually trying to get back to its old course presents many unique engineering problems and keeps the engineers continually on their toes. Practically the whole of the camp was built by the Sappers themselves as their trade training, while at the same time they were being trained as military engineers.

Chilliwack Camp has been visited by many Royal Engineer officers, including one Engineer-in-chief of the British Army, and has been described as having the finest location in the British Empire for an engineer School, with many advantages over the general run of Military Establishments. In the moderate climate outdoor training can be carried out practically every day of the year, and the terrain is suitable for any type of Military and engineer training.

Training rights have been obtained from the B.C. Government in approximately 300 square miles of the virgin Chilliwack River valley, which provides varied types of terrain. The Cheam range has mountains up to 7000 feet high, with winter snow conditions, suitable for mountain warfare; dense forests and swampy jungle-like lowlands for jungle warfare; the swift Chilliwack and Vedder Rivers and the wide Fraser provide facilities for all types of bridging, rafting, etc.

In the School, instruction is given first in Military subjects to change the man from the street into a soldier, after which he is trained as a " Sapper " in dry and wet-gap bridging, improvised and pile bridging, road and airfield construction, engineer tactics, weapon training, trade training etc. Some of the facilities of the school are:

First class drill halls, lecture rooms, instructional machinery, trade training shops, draughting rooms, fire fighting school, sawmill, planer, shingle mill and logging camp, rock crushing plant, concrete block plant etc. Many of these facilities provide not only experience, but supply scarce training and construction materials and save the cost to the Government.

An axiom which the R.C.S.M.E. has followed with success is that all training should be realistic, and where possible should be of benefit to the community. The result of this policy is that the City of Chilliwack and the Municipality have received help on road work, rock blasting for dyke protection, flood protection of farms, construction of local airfield, etc. and have fallen heir to a number of bridges built in training, all of which has made the engineer camp a welcome part of the community.

Married personnel of the administrative and instructional staff are being provided with cottages located in a well planned townsite adjacent to the main camp. These buildings were designed by engineer officers who were architects and most of the construction was done by R.C.E.'s in trade training.

Besides training Active Force R.C.E. soldiers, the school instructs large numbers of Reserve Force, C.O.T.C. and Army Cadet personnel during the summer months.

The camp offers recreational facilities such as bowling alleys, sports fields, tennis courts, a recreation hall and theatre, a drill hall fitted out as a gymnasium for basketball and badminton, a hobby shop for wood working, leather craft, photography, painting, weaving etc. These were, in most cases, built by the soldiers with materials they had produced. At nearby Cultus Lake the Sappers have a yacht club consisting of nine sailboats including a sloop, dinghys struction was done by R.C.E.'s in trade training.

A weekly newspaper *The Canadian Sapper* published by the camp is rapidly increasing its circulation among ex-R.C.E. soldiers, and keeps all units of the Active Force Army and Reserve Army informed on all Corps activities. It is also a fine medium for keeping old army friends in touch with one another and with their engineer home at Chilliwack.

An Empire " Sapper " war memorial, quarried out of virgin granite on Harrison Mountain and cut and lettered by R.C.E. personnel, has been erected in a park at the R.C.S.M.E. This was unveiled by His Excellency Field Marshal Alexander, Governor-General of Canada, in July, 1946.

The solid sixteen and one half foot cenotaph, originally weighing over 42 tons, has four cardinal and four lesser faces. On one face are inscribed the words: " In memory of all Sappers of the British Empire who have given their lives in the service of their country."

To a great extent, credit for erecting the memorial, and also for the spectacular development of the camp itself, goes to Lt. Col. S. J. Davies, M.C., and Lt. Col. C. N. Mitchell, V.C., M.C., former Commanding Officers of the R.C.S.M.E. It was through their drive and enthusiasm that Chilliwack Camp became what it is today.

Lt. Col. R. E. Wilkins, O.B.E., has been Commandant of the R.C.S.M.E. since 1946, when Colonel Mitchell retired.

CORRESPONDENCE

Ottawa, Apr. 19, 1947

The General Secretary,
The Engineering Institute of Canada,
Montreal, Que.

Dear Sir:

I should like to point out a condition which, although generally known, is of considerable interest to the majority of engineers, especially younger engineers amongst whom I classify myself.

In the last eight years a development has taken place with regard to salaries which, without undue exaggeration, may be termed revolutionary. Salaries have risen a great deal, but the magnitude of the rise has not been the same everywhere. It is well known that in this country the remuneration in some fields of employment has remained constant, or nearly so, while the increment in other cases has been 100 percent.

As a rule, the forces of supply and demand have accounted for most of the altered relationships. The engineering profession as a whole has therefore not suffered, but a few injustices remain to be remedied.

During the last 15 years the trade unions have become vigorous instruments for a broad section of our population to obtain a larger share of social justice. At the same time the progress of professional men, such as engineers, as well as teachers and others has not been on a par as compared to their contribution to the community or their own needs. Of these the engineers, due to their key position in a rapidly expanding industry, have been more fortunate. Yet despite their strategic position—in the confidence of management — or technical knowledge and ability their gains, especially those of the younger engineers, have been relatively smaller than those of the trade unions because the demands of the latter were backed by greater physical pressure.

An amazingly high percentage of graduating engineers sets out into the world today burdened by heavy financial obligations. DVA, too, is merely a transient feature whose effect will be felt only by those graduating between now and 1950. It is clear that, in the face of these difficulties, young engineers will not tend to become the most prolific of fathers and the birth rate amongst this group of the educated section of the population will continue to diminish as it will in the others.

There is, in my mind, a need to remunerate the young engineer more in relation to his needs than in relation to his demonstrated accomplishments. There is no doubt that a slight change in this direction has already taken place in the past and that we, in this hemisphere are farther advanced in the solution of this problem than Europe is likely to be in ten or fifteen years.

The Institute, as the most vigorous professional organization in this country, will in the long run have to use its influence to improve the position of the junior engineer as it has done in the past.

In this letter I have attempted to outline the position of the engineers, especially the younger ones amongst us. It would have led me too far to suggest more positive action. This I have omitted, but it is likely that constructive thought on the part of other members will eventually prompt it.

Yours very truly,

(Signed) Peter A. Haridge.

Montreal, May 1st, 1947

Mr. Peter A. Haridge,
11 Cooper Street,
Ottawa, Ont.

Dear Mr. Haridge:

Your letter of April 19th addressed to the Engineering Institute was referred to my attention by Mr. L. Austin Wright, General Secretary.

It is with interest that I read your statement of working conditions for the young engineers and also a certain amount of sympathy regarding the question of remuneration. However, I cannot help but feel that in the last years the young engineer has reached a level of salary much more in conformity with his responsibilities than that which obtained a few years ago. There is no doubt that certain lines of engineering are lagging behind and considerable pressure on the part of the Engineering Institute is being exerted on the proper authorities to remedy the situation.

Were we talking of injustice, I would feel more inclined to side with the graduate of approximately ten years ago who started during the time of depression and whose salary in proportion to starting engineers is definitely below the normal expectation.

As you may be aware this committee has been active since the advent of Collective Bargaining regulations by the Dominion of Canada, and it is our intention to continue activities in this direction.

We appreciate your attitude in turning towards the Institute in this regard and trust that you will find our activities satisfactory.

Yours very truly,

(Signed) G. N. Martin, M.E.I.C.,
Member of Committee
Employment Conditions.

Recently E. A. Holbrook of the University of Pittsburgh retired from the posts of Dean of the School of Engineering and the School of Mines. In response to a letter of felicitation from the general secretary, he has sent the following communication. It is published in the *Journal* because it says nice things about the Institute. Coming from Dean Holbrook this means something. His comments will bring some satisfaction to the many people who have shared in shaping and directing Institute policy over the many years.

During his service at Pittsburgh the enrollment in the two schools has increased from 400 to 2,200. He has rendered a great service to the profession through his work on a number of engineering bodies. For six years he was chairman of the Engineers' Council for Professional Development committee in charge of inspecting and accrediting curricula of American engineering colleges.

During the war he was appointed inspector of engineering colleges for the Third Army Corps and at Pittsburgh he initiated the Engineering, Science and Management War Training Programme which taught skills to 25,000 persons. He is the author of over 100 technical papers. (Ed.).

University of Pittsburgh

May 26, 1947.

Dear Dr. Wright:

It was thoughtful of you to write me on April 26, concerning my retirement as Dean here.

Perhaps I should tell you how near I was to becoming a Canadian citizen having lived 3½ years in British Columbia, and 3½ years in Nova Scotia, and inducing a Canadian girl to become my wife and helpmate these 35 years.

Also I want you to know that I envy you Canadian engineers, your Engineering Institute of Canada. Under wise leadership you have solved many problems of the engineering profession that still plague us here in the United States. You are 10 years ahead of us in your thinking.

I long have had the feeling that an educated man should not fear retirement. Rather he should look forward to it as a time, when, freed from the daily grind of an office, he could do many of the things he has dreamed of doing.

For yourself and the Institute, I wish you continued success and accomplishment.

Again thanking you for your letter,

I am,

Sincerely yours,

(Signed) Elmer A. Holbrook.

MEETINGS OF COUNCIL

Minutes of a meeting of the Council of the Institute held at the Royal York Hotel, Toronto, on Friday, May 9th, 1947, convening at two thirty p.m.

Present: President L. F. Grant in the chair; Past-Presidents deGaspe Beaubien, J. B. Hayes and F. A. Gaby; Vice-Presidents R. S. Eadie, G. F. Layne, W. R. Manock and W. L. Saunders; Councillors J. A. Beauchemin, G. M. Brown, F. R. Burfield, P. E. Buss, K. G. Cameron, J. R. Carter, C. S. Clendening, G. J. Currie, J. R. Dunbar, R. C. Flitton, S. R. Frost, C. E. Gelinas, C. B. Hamilton, Jr., N. B. Hutcheon, J. H. Irvine, Viggo Jepsen, A. R. Jones, W. H. M. Laughlin, J. G. MacGregor, G. L. Macpherson, A. H. MacQuarrie, V. A. McKillop, Norman Marr, L. E. Mitchell, P. M. Sauder, D. M. Stephens, J. B. Stirling, Paul Vincent; Past-Vice-President C. E. Sisson; Past-Councillors J. A. Lalonde, J. M. Patton, J. A. Vance, J. F. Wickenden, and W. S. Wilson; General Secretary L. Austin Wright and Assistant General Secretary W. D. Laird.

Appointment of General Secretary: On the motion of Mr. Vincent, seconded by Mr. Stirling, it was unanimously resolved that L. Austin Wright be re-appointed general secretary of the Institute.

Appointment of Treasurer: The appointment of a new treasurer was left in the hands of Council.

Appointment of Committees: On the recommendation of the Striking Committee it was unanimously resolved that the chairmen of Institute committees for the year 1947 be appointed as follows, and that they be asked to submit the names of the other members of their committees for the approval of Council at the June meeting: Finance, R. S. Eadie; Library and House, R. C. Flitton; Papers, S. G. Coultis; Publication, C. E. Gelinas; Legislation, J. A. Beauchemin; Admissions, C. A. Peachey; Board of Examiners, R. DeL. French; Membership, H. R. Sills; Employment Conditions, G. N. Martin; Community Planning, R. L. Dobbin; Engineer in the Civil Service, N. B. MacRostie; Prairie Water Problems, G. A. Gaherty; The Young Engineer, G. R. Langley; Professional Interests, J. B. Stirling; Julian C. Smith Medal, L. F. Grant; Gzowski Medal, C. G. Moon; Duggan Medal and Prize, H. M. White; Plummer Medal, J. R. Donald; Leonard Medal, G. E. Cole; Keefer Medal, R. L. Hearn; Ross Medal, D. Anderson; Canadian Lumbermen's Association Prize, J. L. Lang; H. N. Ruttan Prize, S. G. Coultis; John Galbraith Prize, W. L. Saunders; Phelps Johnson Prize, R. S. Eadie; Ernest Marceau Prize, G. F. Layne; Martin Murphy Prize, C. M. Anson.

Finance Committee: Mr. Eadie, chairman of the Finance Committee, announced that the membership of his committee would be—J. E. Armstrong, I. R. Tait, the new treasurer when appointed, and one other member whose name would be submitted at the next meeting of Council.

Banff Meeting—June 1948: Colonel Grant reminded Council that at the September meeting of Council, held in Digby, Nova Scotia, the invitation of the Calgary Branch to hold a meeting at Banff in June 1948 had been enthusiastically accepted, but no decision had been reached at that time as to whether it would be the annual general meeting or a western professional meeting. The matter had since been discussed at several council meetings, and at the meeting held on May 7th, at which almost all the branches of the Institute were represented, a large majority of the members present had been in favour of making it the annual meeting of the Institute.

As councillor from the Calgary Branch, Mr. MacGregor moved that the meeting to be held in Banff in June 1948 be the annual general meeting of the Institute. The western members would consider it an honour and a privilege if the Institute would hold the annual meeting there. He assured the Council that the western branches would endeavour to extend the same hospitality as had been received in Toronto. Mr. Clendening, of Lethbridge, had great pleasure in seconding the motion.

The general secretary reported that accommodation had been reserved at the hotel for the first week in June, but that since coming to Toronto the C.P.R. Convention Manager had informed him that it might be possible to secure the second week in June. This might possibly be better than the first week, particularly in working out co-operative meetings with the A.S.M.E. and the A.S.C.E. which it had been suggested might be done.

Following some discussion, it was enthusiastically agreed that the annual general and general professional meeting of the Institute be held in Banff, Alberta, during the first or second week of June 1948.

Alberta Agreement: Mr. Sauder, as councillor representing the Association of Professional Engineers of Alberta, had been asked to discuss the cooperative agreement with particular reference to the financial arrangements. The general secretary reviewed briefly the present system of collecting and distributing to Headquarters and the branches the annual fees of joint members. The matter was at the moment being discussed by correspondence between the Institute and the Association. Mr. Sauder suggested that on his next visit to the west the general secretary should discuss this question with the Association executive. This the general secretary agreed to do.

Student and Junior Prizes: Mr. Dunbar pointed out that no award of the John Galbraith Prize had been made for the year 1946 and he wondered if it would be permissible to make two awards for the year 1947. It was agreed that this would be in order.

Vote of Thanks to Retiring Councillors: Past-President Gaby asked for the honor of proposing a vote of thanks to the president and retiring councillors for their services. He stated that he was appreciative of the excellent service which Mr. Hayes had rendered to the Institute. He knew the great volume of work done by the Montreal councillors. In looking back over the past he could see that many problems had been met and solved and that there still was much for the future. He congratulated the president on having visited all the branches and on having attended the conference in the Old Country, and concluded by moving a very hearty vote of thanks to the president and retiring councillors for the excellent work they had accomplished through the year. This was approved unanimously.

Vote of Thanks to Toronto Branch: Past-President Hayes commented on the pleasure it gave people from the far east to get to places like Toronto now that the war was over and to participate in normal activities. He wanted to express to the Toronto Branch not only his own appreciation but that of the councillors for excellent hospitality. This was approved unanimously.

Date of Next Council Meeting: The general secretary recommended that the next meeting of Council be held late in the month of June as it was customary to omit the meeting in July and sometimes in August as well. Under these circumstances, a late meeting in June and an early one in September would shorten the interval between meetings. It was unanimously agreed that it be left with the president and general secretary to determine the date of the June meeting.

The Council rose at three thirty P.M.

L. Austin Wright,
General Secretary.

Minutes of a meeting of the Council of the Institute held at Headquarters on Saturday, June 21st, 1947, convening at nine thirty a.m.

Present: President L. F. Grant (Kingston) in the chair; Vice-Presidents R. S. Eadie (Montreal), W. R. Manock (Fort Erie), and W. L. Saunders (Ottawa); Councillors P. E. Buss (Thorold), K. G. Cameron (Montreal), J. R. Dunbar (Hamilton), R. C. Flitton (Montreal), J. H. Irvine (Ottawa), R. A. Jones (Peterborough), E. Lavigne (Quebec), J. B. Stirling (Montreal), W. J. Thomson (Arvida), P. Vincent (Quebec); General Secretary L. Austin Wright and Assistant General Secretary W. D. Laird.

The minutes of the meetings held on May 7th and 9th, 1947, were taken as read and approved.

The general secretary explained, principally for the benefit of new councillors at this meeting, that the minutes of Council are based on the verbatim but that the draft of minutes for items of special interest is usually submitted to the chairman of the appropriate committee or some other officer of the Institute before they are circulated. He explained further that on some subjects a great deal of space was devoted to details so that the councillors who were not present would have a better idea of the discussion which preceded the decision. It was also part of his policy to include the opinions on both sides of a discussion, again for the purpose of giving to the person who was not present a better idea of the discussion.

Death of Councillor Baron Boris deHueck: The president informed the meeting that Baron Boris deHueck, councillor for the Cornwall Branch, had died in Montreal on June 10th, 1947. It was agreed unanimously that the general secretary write to the Baroness conveying Council's sympathy, at the same time expressing the sense of loss felt by members of Council and the Cornwall Branch on losing such a staunch supporter and loyal friend.

Business Arising from the Minutes

Ontario Provincial Division: The president asked Vice-President Manock, chairman of the Division, for a report on the meeting held in Toronto on May 10th.

Mr. Manock reported that at that meeting he had been appointed chairman of the Division, with J. R. Dunbar, of Hamilton, as vice-chairman, E. R. Graydon, of Toronto, secretary, and G. R. Turner, of Ottawa, treasurer. A by-laws committee was established with S. R. Frost, of Toronto as chairman. This latter committee had not yet had an opportunity to meet and therefore it had no progress to report.

He reported further that the first resolution of the Division was to send a message of cordial greetings to the Association of Professional Engineers of Ontario, at the same time expressing the Division's desire to cooperate with the Association on any occasion when it would react to the benefit of the profession.

The president reported that he had had a meeting with Dr. G. B. Langford, of Toronto, president of the Ontario Association. The object of the meeting was simply to promote cordial relations between the two organizations. It was of a very informal nature but did permit a discussion on several subjects of mutual interest. As their conversations were informal and off the record, Colonel Grant did not think that they should become a part of the business of this meeting, but he reported the interview as very pleasant and permitting a rather broad discussion on subjects where it is desirable that mutuality of the interests of the two organizations be recognized and advanced.

Committee on Professional Interests

(a) *Letters from Saguenay and Winnipeg Branches:* Mr. Stirling reported that no further action had been taken on these letters but he hoped to have a report for the next meeting of Council.

(b) *Parliamentary and Scientific Committee in Canada:* At the last meeting of Council this matter had been referred to the Committee on Professional Interests and Mr. Stirling reported that he has received from the general secretary a very complete report prepared by Past-President K. M. Cameron who had attended a meeting in Ottawa recently at which Mr. Howe and several of the leading engineers in government circles had endorsed the idea of establishing such a committee. Mr. Stirling had hoped to be in Ottawa during the week to discuss the matter with Mr. Howe but had been unable to do so. He expected to see Mr. Howe before the next meeting of Council and would then present a definite report on the matter.

(c) *Canadian Council:* Mr. Stirling presented a written report for the consideration of the meeting, explaining that the discussion at the annual meeting of Council in Toronto in May had seemed to indicate that the committee should reach a final decision as to what should be done with regard to publicity on this subject. The report follows:

The President and Council
The Engineering Institute of Canada.

Gentlemen:

From time to time during the past three years the question as to whether or not The Engineering Institute of Canada should support the new Canadian Council of Professional Engineers and Scientists has been before Council.

When the matter first arose it was considered a fitting time to formulate a policy which would serve not only as a basis for decision in this particular matter but in the broader subject of relationship with sister societies.

Late in 1944 your Committee on Professional Interests developed a Statement of Principles and Policy in relation to Sister Societies. Before this statement was submitted to Council it had been submitted to all past-presidents, vice-presidents, councillors, and the Councils of the provincial associations of professional engineers with which the Institute has agreements. From all those, not a single negative response was received. When submitted to the Annual Meeting of Council in Winnipeg in 1945, it was endorsed unanimously, and the endorsation has been reaffirmed at several meetings since then.

In all Council's deliberations concerning the statement, discussion was focussed on the matter of support for the C.C.P.E. & S. and in every instance support was withheld by *unanimous* decision.

Reasons for this were stated fully in *The Engineering Journal* at the following times:

June 1945—Page 391: " Report to the Membership from the Committee on Professional Interests ".

June 1945—Pages 399-400: Minutes of Council Meeting " Reports from the Committee on Professional Interests ".

August 1946—Pages 488-489: " The Institute Policy towards New Council of Engineers and Scientists .

June 1947—Pages 278 and 290-292: Discussions at Annual General Meeting Annual Council Meeting, May 1947.

In addition to which the entire membership was circularized by direct mail in January 1947.

From time to time the matter has been discussed with individual members, branch officers and some of the professional associations, the Quebec Corporation and also at branch meetings. The most recent public discussion took place at the Annual Meeting of the Institute in Toronto when, without advance notice, a resolution was placed before the meeting to the effect that a referendum be taken by the Institute on the question of support for the new council. Afer a long and full discussion the motion was put and was defeated, only 10 persons supporting it out of a meeting of approximately 300. This result is more conclusive and meaningful when it is considered:

(1) That the motion was sponsored by members who from its inception have been promoting the new organization and who had every opportunity to present their case before an open forum.
(2) The vote was taken in a city, claimed to have large support for the C.C.P.E. & S.
(3) A representative cross section of membership from coast to coast was present and took part in the discussion.

Your committee would point out:

(1) That the arguments already put forth by both the Institute and the C.C.P.E. & S. cannot be materially enlarged upon.
(2) That the subject has been worn threadbare, and no useful purpose can be acheived in further discussing it. Indeed, such discussion promotes disunity in the profession.
(3) That some of the previous supporters of the C.C.P.E. & S., including the Canadian Institute of Surveying, the Royal Architectural Institute of Canada and others, have withdrawn their support. Judging from the minutes of this year's annual meeting of the Dominion Council of Professional Engineers, that organization, too, finds it necessary to withdraw its official support.
(4) That the C.C.P.E. & S. has recruited two organizations recently which have not the remotest connection with the engineering profession thereby weakening the " front ".
(5) An exchange of correspondence between this committee and the Canadian Council for the purpose of finding some means of getting together ended when the Canadian Council failed to reply to the committee's letter of August last.
(6) The Canadian Council in a published statement by its president now claims—" The (Canadian) Council is rapidly gaining recognition as the mind and voice of professional engineers. . . .in Canada ". To this statement the E.I.C. could not under any circumstances subscribe and its promulgation by the Canadian Council indicates how far apart we are and at the same time indicates how ambitious the organization may be in duplicating or replacing existing well established organizations.
(7) The committee believes that much more time and attention have been given to this proposal than it deserves. The evidence indicates that a small but active group has been and still is agitating the members of different organizations, including the Institute, to keep the subject alive. Without in any way wishing to deprecate the intentions of the organizations still supporting the C.C.P.E. & S. the committee believes that because of the activities of the small group just refererd to, emphasis out of all proportion to its importance has been given to the subject.

Your committee desires to have a directive from Council as to future action. A number of suggestions were made at the meeting of Council in Toronto based on observations that the Institute's publicity on the matter has not been adequate.

Your committee assumes all responsibility for these matters and will only say that its statements have been made in the light of circumstances as they could evaluate them.

For the future we suggest that the committee has done about all that it can do in the matter. It suggests that any further exposition of Institute policy might be made:

(1) By Council issuing a statement as to where

the information concerning the subject can be found in *The Engineering Journal.* This suggestion was made at the Toronto meeting but the discussion was terminated without definite instructions.

and/or

(2) the matter be discussed at branch meetings by the president and other Institute officers with him on the 1947 branch visits now about to be undertaken.

The consideration by Council of this matter will be much appreciated by the committee.

Respectfully submitted,

(Signed) J. B. Stirling, *Chairman,*
Committee on Professional Interests.

Montreal, June 20th, 1947.

In amplifying his report Mr. Stirling stated that from time to time the committee, either directly or through Council, receives letters and sometimes resolutions relating to the Institute's policy on this particular subject. These with few exceptions were cleared up satisfactorily to everyone by an interview or by an exchange of correspondence. In other words, the membership supported Council's policy once they had the full information before them. However, his committee did not wish to continue this sort of special individual treatment. They felt that from now on this matter should be entirely in the hands of the officers of the Institute. He felt it was ineffective to print the material in the *Journal* as had been proven by the discussion at the May meeting of Council. In spite of the amount of publicity given this subject in the *Journal* many members and even councillors were still not conversant with it.

The president suggested that members should be invited to ask questions on this subject during his tour of the branches. He agreed that the material had been well publicized in the *Journal* but from his teaching experience he realised that many people did not retain information unless it is repeated to them many times.

In response to the president's inquiry, Mr. Stirling expressed the opinion that further publicity on the subject should not be attempted. He thought the matter had received more attention than necessary but that it might be settled finally to the satisfaction of all members when the president makes his tour.

Mr. Buss supported the report fully, pointing out that the committee had done a very complete job and should now be relieved of any further responsibility towards it. Therefore he moved that the matter be dealt with by the president and other officers of the Institute and branches and that the committee be relieved of further concern in the matter and that they be thanked sincerely for the splendid work they have done. This was seconded by Mr. Flitton.

Mr. Eadie suggested that Mr. Stirling's report be printed in the minutes of Council.

Mr. Flitton supported the idea of the report being printed. It was his experience that often " agitators " did not have the facts and frequently are not interested in getting them.

Mr. Cameron stated that he had not been well informed on this subject previous to the first meeting of Council which he had attended in May. He could not recall having read the various reports in the *Journal.* He asked many questions about the new council, particularly about the constituent membership, pointing out that in his opinion if the members knew of the heterogeneous nature of this membership they would quickly see good reasons for the Institute's failure to support it.

The president supported Mr. Cameron's remarks, stating that he, too, had found it difficult to be properly informed of the various bodies now in or impinging on the engineering field. Therefore, he was sympathetic with the member who, because of lack of information, was critical of Council's policy.

The president then summarized the motion and the discussion, concluding with the suggestion that he often thought that a comprehensive history of the whole thing from the start might be of considerable benefit.

The general secretary stated that the trouble with such a history is that there are several very important pieces of information which would be difficult to discuss publicly. These were significant in judging the purposes and the possible usefulness of the new organization, but were not of a nature that they should be printed in the *Journal.* Without these particular items the history would not be complete.

He then proceeded to give Council a brief outline of the history of the movement for the formation of a new overall body which would bring the councillors pretty well up to date on the whole matter. At this point the president put the motion, which was carried unanimously.

Student Conference: The general secretary gave a brief account of the conference which was held in Toronto on Saturday, May 10th, with Dr. G. R. Langley, chairman of the Institute's Committee on the Training and Welfare of the Young Engineer, in the chair. The Institute had financed the cost of bringing to the annual meeting the president or vice-president of each of the undergraduate engineering societies in all Canadian universities. The purpose was to discuss with the students themselves ways and means by which the Institute could enlarge its values for them. The meeting had lasted from nine thirty in the morning until six thirty in the evening and was attended by fifteen undergraduates in addition to which there were nine senior members of the Institute sitting in as observers. Mr. Wright concluded by presenting a communication from the chairman of the resolutions committee followed by the resolutions themselves. (NOTE: As the conference is being written up in detail in the *Journal* further details are not being given here).

The president reported that he had just returned from the summer annual meeting of the American Society of Mechanical Engineers in Chicago. At that meeting he was invited to sit in with their educational committee during which he heard Colonel Davies, secretary of the A.S.M.E., speak very highly of the Institute's student conference. Colonel Davies had been an observer throughout most of the conference.

Dealing with the resolution proposing that the conference should be regarded as an annual affair, the president stated that in his opinion the meeting was of unusual value and, providing the Institute finances could meet the expenses, thought the meeting should be held annually. He thought eventually it would turn out to be a very good financial investment, at the same time make many friends for the Institute, and be especially useful to the students.

Mr. Saunders was of the opinion that work of this kind among the students was one of the most important activities in which the Institute could be engaged. The history of membership indicated that those who joined as students became the staunchest supporters of the Institute and maintained their membership continuously.

It was moved by Mr. Eadie, seconded by Mr. Jones, and carried unanimously, that the resolutions be referred to the Committee on the Training and Welfare of the Young Engineer for study and report.

Brian Perry Case: For the benefit of new councillors the general secretary explained that a joint committee of the Institute and the Corporation of Professional Engineers of Quebec had been set up some time ago as an advisory group in the conduct of the case of Brian R. Perry vs. the Province of Quebec Association of Architects.

The general secretary then presented to Council the minutes of the meetings held by this committee on May 12th and 16th, which concluded with the following statement:

"After properly weighing these aspects of the situation it was unanimously agreed that the committee did not favour any furtherance of the case before the Courts, as it would generally prove more of a deterrent than an aid for any wholesome negotiations with the architects and the provincial government."

Mr. Wright reported also that a communication had been received from the Corporation of Professional Engineers of Quebec stating that this report had already been accepted by the Corporation and that as the date had now passed for making any further appeal against the decision there seemed to be no further action to take.

The president commented that under these circumstances the report was simply for the information of Council and that no action was required.

On Mr. Eadie's motion, seconded by Mr. Lariviere, it was unanimously resolved that the report be accepted that the Institute's panel be thanked for their work.

Committee on Community Planning: The general secretary reported that the Community Planning Association of Canada (of which the Institute is a member) was holding its first annual meeting in Montreal early in October. As the Institute's Committee on Community Planning had been authorized to hold a conference in Toronto on November 13th, some concern had been expressed as to the possibility of overlapping or conflict between these two functions. He reported that the matter had been discussed recently with the chairman of the committee and with the secretary of the C.P.A.C. and out of the conversations it appeared as if the two programmes could be carried out as planned without interference or injury to either.

Mr. Cameron stated that as a new councillor he was not fully informed as to the work of the Institute's committee on this subject. He remarked that a great many organizations of different types were interested in this subject but that each one seemed to be working on its own.

The president explained that the Institute was trying to get engineers interested in the subject so that the engineering features of the subject would not be completely ignored. He felt that if the Institute did not show an interest in the subject the profession might lose its interest in it "by default".

The general secretary stated that it was one of the primary objects of the Institute's committee to advance the engineers' interest in the topic and the public's awareness of it. The committee believed that by promoting the subject before all the branches, members could be prompted to take a greater interest in local planning.

The committee was also interested in preparing a manual dealing with the fundamentals of planning. Such information was sadly lacking as could be seen in much literature prepared on the subject.

The general secretary's statement was accepted as a progress report.

Canadian Committee for Student Guidance in Science and Engineering: For the information of new councillors the general secretary described briefly the set up of this committee which had developed through the work of the Institute's Committee on the Training and Welfare of the Young Engineer, established in 1939 under the chairmanship of the late Harry F. Bennett. Under this main committee counselling committees had been set up right across Canada to give advice to prospective engineers. During the war, through the Wartime Bureau of Technical Personnel, it had been suggested that this committee might be made a co-operative effort and used to assist the Bureau in locating and training young engineers for positions which they were unable to fill. The Institute had agreed, and accordingly the Canadian Committee for Student Guidance in Science and Engineering had been set up with representatives of the Canadian Institute of Mining and Metallurgy, the Chemical Institute of Canada and the Engineering Institute. Up until now that committee had been using the E.I.C. booklet "The Profession of Engineering in Canada", but it had now been suggested that a new booklet should be prepared to include other subjects than engineering, such as pure science, geology, physics, etc.

Mr. Wright had recently had an opportunity to discuss this with Mr. McClelland, the secretary of the committee, and it had been suggested that the new booklet might be issued in two parts, one on engineering subjects and the other to include pure science and other subjects.

Colonel Grant outlined the discussions which had taken place in the meetings of the joint committee since he had taken over as the Institute's representative. At the end of the war the question had arisen as to whether or not the committee should be continued and it had been decided that it should be. The other two societies were very much in favour of continuing the work.

Mr. Eadie pointed out that up until now the Institute had assumed the responsibility for the full cost of the booklet used by the joint committee and he asked if the other two societies would contribute anything towards the cost of the new booklet.

Colonel Grant replied that it had been suggested that the Institute should pay half of the cost and the other two societies a quarter each.

Mr. Saunders pointed out that the provincial governments were very much interested in vocational education and would probably be willing to contribute something towards the cost of such a booklet. He also thought that the universities which distribute this booklet in large quantities should contribute something towards its cost.

Colonel Grant thought that at this time, in conjunction with the revised booklet, consideration should also be given to a later item on the agenda dealing with a recommendation from the Institute's Committee on the Training and Welfare of the Young Engineer to the effect that Council approve the necessary expenditure for the compiling and publishing of a booklet containing one hundred case histories of representative engineering jobs, these histories to be supplied anonymously by actual incumbents of the various jobs described.

Colonel Grant pointed out that two points had to be decided upon: (1) Whether or not the Institute was prepared to share with the other two societies in the cost and work of the preparation of the revised booklet; (2) What about the new case history booklet recommended by the Committee on the Young Engineer?

With regard to Item 1, Mr. Wright could foresee some difficulty in getting this revised booklet prepared on a cooperative basis. It had taken Mr. Bennett's committee a long time to get final approval on some of the paragraphs of the present booklet with only the Institute to consider.

Mr. Stirling pointed out that it was tradition of the Institute always to cooperate wherever possible, and he felt that it would be most desirable to continue cooperation in this matter.

Following further discussion, on the motion of Mr. Vincent, seconded by Mr. Dunbar, it was unanimously agreed that the Institute is prepared to join with the Canadian Institute of Mining and Metallurgy and the Chemical Institute of Canada in producing a new booklet descriptive of the branches of the profession which they represent; the cost of such a booklet to be borne by the three societies pro rata to their membership; and further, the Council recommends that the committee consider the desirability of charging universities and high schools a reasonable price for the booklets which they distribute.

Committee on the Young Engineer: The general secretary then read the letter from Dr. Langley, chairman of the Institute's Committee on the Training and Welfare of the Young Engineer, transmitting the recommendation of the committee regarding the preparation of a booklet of case histories. In the first paragraph the committee asked that Council approve the expenditure, but Mr. Wright pointed out that at the moment no one had any idea what the cost would be and in his opinion it would be very difficult, if not impossible, to get one hundred case histories prepared.

Mr. Eadie inquired as to whether this case history booklet would be issued as a separate booklet or printed as part of the revised booklet already approved. As a modification, Mr. Jones suggested that representative case histories might be prepared and added to the booklet already approved.

Colonel Grant thought this would be the correct thing to do, and after considerable discussion, on the motion of Mr. Jones, seconded by Mr. Cameron, it was unanimously agreed that the suggestion of the Committee on the Young Engineer be approved; that the number of case histories be considerably reduced, probably to two for each branch of engineering, and that these be incorporated in the revised booklet already approved by Council.

Awards to Undergraduates: The general secretary read a letter from Dr. Langley advising that at a meeting of the Committee on the Young Engineer held in Toronto on May 8th, unanimous approval had been given to a certain recommendation that Council be asked to institute additional awards to undergraduates.

Mr. Langley reported also that at the meeting of representatives of undergraduate engineering societies held on May 10th, unanimous approval had been given to the suggestion.

Mr. Vincent mentioned the $25.00 cash prizes now given by the Institute to students in the pre-graduation year at eleven universities. These prizes were very highly regarded by the student body, and he suggested that any new awards for engineering students should be in addition to those already established.

Mr. Wright suggested that it would be desirable to obtain the support of the universities before making such additional awards.

Colonel Grant was in favour of the suggestion, more particularly because the students themselves had been very keen about it. They had thought it would be a good way for the Institute to advertise itself to the student body. Mr. Eadie was of the opinion that if any such awards were instituted they should be given to third year students who would continue at the university.

Following some discussion, on the motion of Mr. Dunbar, seconded by Mr. Vincent, it was unanimously agreed that Council approves of the proposal in principle, but refers it back to Dr. Langley's committee for further delineation of the details.

The Council adjourned for lunch at one o'clock and reconvened at two fifteen p.m. with the president in the chair.

Appointment of Treasurer: On the motion of Mr. Eadie seconded by Mr. Flitton, it was unanimously resolved that L. C. Jacobs be appointed treasurer of the Institute for the year 1947.

Appointment of Committees: On the motion of Mr. Buss, seconded by Mr. Manock, it was unanimously resolved that the membership of the various committees, as submitted by the chairmen, be approved.

Canadian Chamber of Commerce: At the request of Council, Past-President Surveyer, the Institute's representative on the National Board of the Canadian Chamber of Commerce, had discussed with the secretary of that organization the increased fee which the Institute had been assessed for the year 1947. It was suggested that as a non-profit, non-commercial organization, there might be some other basis of membership for the Institute.

Dr. Surveyer had been informed that a number of other non-profit organizations had paid the same fee and it appeared that nothing further could be done.

Commenting on the value of Institute membership in this organization, the general secretary drew attention to reports which the Institute receives regularly dealing with proposed new legislation. Mr. Stirling knew that the Canadian Chamber of Commerce had a very active legislation group which kept in close touch with all proposed legislation, and in his opinion it was an excellent thing for the Institute to receive these reports.

Dr. Surveyer's report was noted and as the Institute has already paid the higher fee and is continuing its membership, no further action was necessary.

REPORT OF FINANCE COMMITTEE

Financial Statement: It was noted that the financial statement to the end of May had been examined and approved. The figures showed a substantial increase in revenue due, principally, to the increase in the annual fee.

President's Expenses: Mr. Eadie reminded Council that when the Finance Committee had put forward the proposal for an increase in annual fees in 1945 one of the items they had hoped to meet by this increase was the president's travelling expenses. This had been approved in principle by the membership when they voted in favour of the increase of fees. The Finance Committee was now recommending to Council that this be done, and on the motion of Mr. Eadie, seconded by Mr. Dunbar, it was unanimously resolved that the Institute reimburse the president for his expenses entailed in carrying out the duties of his office, within a specified limitation.

Pension Plan for Headquarters Staff: Mr. Eadie reported that information on pension plans for the staff had been secured from the Government Annuity Branch and a private insurance company. These were being studied by the Finance Committee and it was hoped that a report would be ready for the next meeting of Council. This progress report was noted.

Branch Conference: The general secretary reported that a very successful meeting of representatives from the various branches had been held during the recent annual meeting in Toronto. He presented a letter from the secretary of the Montreal Branch suggesting that a similar conference be held annually at the time of the annual meeting; that one whole day be devoted to it, and making detailed suggestions as to the agenda and the arrangements for such a meeting.

It was pointed out that most of the suggestions made by the Montreal Branch would come to Council through the minutes of the meeting of branch representatives and therefore no action was necessary at this time. The general secretary was directed to acknowledge receipt of the letter and to inform the Montreal Branch that the matter would be up for further consideration in due course.

Annual Meeting Publicity: The general secretary presented a report which he had prepared on the publicity received in the newspapers across Canada on the recent annual meeting. He read his report which appears in the Month to Month section of this *Journal*. He pointed out that for many years the newspaper publicity in connection with annual meetings has been handled by one of our members, R. C. Purser, of Ottawa, a free lance writer. Mr. Purser works on this for about two months before the meeting, writing editorials, biographies of new councillors, prize winners, etc.

On the motion of Mr. Vincent, seconded by Mr. Irvine, it was unanimously resolved that the thanks of the Council be extended to Mr. Purser for the excellent work he had done. It was unanimously agreed that the report be published in the *Journal* for the information of the membership.

Amendments to Saskatchewan Agreement: The general secretary reported that he had been in correspondence with the Saskatchewan Association regarding the amendments necessary to the agreement in order to cover the increase in annual fees of Institute members. The Council of the Association now recommended that Clause 6 be amended by deleting the first sentence of the first paragraph and substituting therefor the following:

"The Association will pay to the Institute in lieu of the ordinary membership fees of the Institute the sum of Nine Dollars and Seventy-five Cents ($9.75) per annum for each member of the Association having the Institute classification of Member (M.E.I.C.); the sum of Four Dollars and Fifty Cents ($4.50) per annum for each member of the Association having the Institute classification of Junior, and Two Dollars ($2.00) per annum for each member of the Association having the Institute classification of Student."

The Council of the Association also recommended that the agreement be amended by the addition of the following clause (Presumably "7a"):

"In lieu of the retention by the Association of the normal rebate under the Institute by-laws, the Association guarantees to pay all branch expenses up to, but not exceeding, the normal rebate required under the Institute by-laws."

The general secretary pointed out that the financing of the Saskatchewan Branch is rather different from that of other branches inasmuch as the Institute branch and the Saskatchewan Association operate as one and the same body, having the same officers and the same executive committee which is responsible for the financing and management of the Institute branch.

Following some discussion, on the motion of Mr. Stirling, seconded by Mr. Eadie, it was unanimously resolved that the proposed amendments to the Saskatchewan agreement be approved, and that the president and the general secretary, or alternates named by them, be authorized to sign the official documents.

Councillor for Saskatchewan Association: On the motion of Mr. Vincent, seconded by Mr. Manock, the appointment of Mr. G. W. Parkinson as the representative of the Association of Professional Engineers of Saskatchewan on the Institute Council for the year 1947 was unanimously approved.

Clarification of Rules for the Duggan Award: In accepting the chairmanship of the Duggan Medal and Prize Committee for another year, Mr. H. M. White requests Council to clarify the rules and regulations governing this award. He has already submitted his suggestions and hoped that Council will be able to take action on this matter at an early date. On the motion of Mr. Jones, seconded by Mr. Flitton, it was unanimously agreed that the matter be referred to Vice-President Eadie for consideration and report to the next meeting of Council after consultation with Mr. White.

Remuneration of Engineers in the Naval Service: The general secretary reported that his attention had been called to a situation involving engineers in the Royal Canadian Navy which appeared to be detrimental to the individual and to the service. Briefly, the situation is that medical and dental officers now receive a "responsibility allowance" of $60.00 a month regardless of rank and that executive and supply officers are given a "responsibility allowance" varying from $30.00 to $90.00 a month depending upon the responsibilities of their command. On the other hand, the engineers received no extra remuneration at all.

Mr. Wright gave a comparison of the services rendered by the three different groups which indicated that the engineer was more entitled to a special remuneration than were the others. He was of the opinion that this policy would defeat the Navy in their proposal to obtain high class engineer officers and in fact already had seen evidence that proved that this was already taking place.

Acting on the information, Mr. Wright had gone to Ottawa and discussed the matter in considerable detail with certain persons who were adequately informed on it and as a result of his investigations he recommended that Council should prepare a report for the Minister of National Defence asking for at least equality of treatment for the engineers. It was moved by Mr. Flitton, seconded by Mr. Vincent, and carried unanimously, that this action be taken.

Société des Ingénieurs Civils de France: A letter had just been received from the president of the Société des Ingénieurs Civils de France, inviting the Institute to be represented at a meeting to be held in Paris on June 26th and 27th. As it was too late to arrange for direct representation it was unanimously resolved that the greetings and good wishes of the Institute be forwarded by cable to the president of the society.

Campaign for Increased Membership: Colonel Grant reported receipt of a letter from Mr. Hubert Sills, of Peterborough, in which he urged the desirability of the Institute branches, particularly in the province of Ontario, making a strong drive for new members. He has prepared a detailed programme and, as chairman of the Institute's Membership Committee, is willing to take the initiative in planning and organizing such a campaign through the branch membership committees, providing that the cost of secretarial assistance can be met by the Institute.

Colonel Grant thought this was one of the most encouraging and constructive suggestions which had come to him. He was sorry not to get the letter to members of Council before the meeting, but it had reached him only within the last day or so. He was strongly in favour of giving Mr. Sills the assistance he required and the authority to go ahead.

As a member of the Peterborough Branch Mr. Jones had had some part in preparing the statement submitted by Mr. Sills, and he had much pleasure in moving that Mr. Sills be authorized to go ahead along the lines indicated in his letter and that he be given the stenographic assistance required. This motion was seconded by Mr. Flitton and carried unanimously.

Congratulations to Dr. G. R. Langley: On the motion of Mr. Flitton, seconded by Mr. Vincent, it was unanimously resolved that the congratulations of Council be extended to G. R. Langley, M.E.I.C., on receiving the honorary degree of Doctor of Science, from Union College, Schenectady, New York.

REPORT OF ADMISSIONS COMMITTEE

Transfers from Junior to Member: The committee reported that over three hundred applications for transfer from the class of Junior to that of Member had been received following the circularizing of all Juniors notifying them of their privileges under the revised by-laws. The task of "processing" these applications is tremendous. For instance, each applicant will have at least five references to be canvassed, and the replies recorded, which will mean three thousand separate communications. In order to reduce the volume of work and the expense, the committee submitted for Council's approval, certain recommendations as to changes in procedure to be effective for the year 1947.

Following considerable discussion, on the motion of Mr. Dunbar, seconded by Mr. Saunders, it was unanimously agreed that these recommendations be approved, with the exception that in the case of canvassing the councillors, it shall be arranged that the councillors will return either the covering letter or the list of applications containing a signed statement indicating that they are in favour of all the transfers subject to such exceptions as are noted on the letter or the list.

Date of next Council Meeting: It was left with the president and the general secretary to decide upon the date for the next meeting of Council, it being the usual custom not to hold a meeting in July or August unless urgent business required it.

The Council rose at four fifty P.M.

L. Austin Wright,
General Secretary.

ELECTIONS AND TRANSFERS

A number of applications were presented for consideration, and on the recommendation of the Admissions Committee, the following elections and transfers were effected:

Members

Abbott, Ross Hughson, B.Sc., (Chem.Engrg.), Queen's, dftsman., engrg. dept., North American Cyanamid Ltd., Niagara Falls, Ont.

Bacon, Charles Ives, B.Sc., (Elec.Engrg.), Nova Scotia Tech., mgr., Stormont Electric Light & Power Ltd., Cornwall Street Rly. Light & Power Co., Cornwall, Ont.

Bowles, George William, B.Sc., (Elect.Engrg.), Manitoba, elect. engr., Howard Smith Paper Mills Ltd., Montreal, Que.

Bright, John Eric, B.Sc., (Mech.), Queen's, engr., Post War Reconstrn., Dept. of Public Works of Canada, London, Ont.

Cann, Harry Alexander, B.Sc., (Civil Engrg.), Manitoba, sales engr., ind. divn., Dominion Rubber Co., Edmonton, Alta.

Carruthers, William Kent, B.Sc., (Elect.Engrg.), Alberta, engr., Montreal Engrg. Co., Ltd., Montreal, Que.

Cote, Albert Peter, Capt., R.C.S., B.Sc., (chemistry), Queen's, Vimy Barracks, Kingston, Ont.

Curtis, Maurice Leonard, Interim B.Sc., (London Univ.), sr. engr., J. D. Woods & Gordon Ltd., Toronto, Ont.

Denham, Donald, engr. surveyor, inspector of boilers and machinery, British Columbia Government, Vancouver, B.C.

Dies, G. Donald, B.Sc., (Metall.Engrg.), Queen's, constrn. engr., Canada Cement Co., Ltd., Belleville, Ont.

Drysdale, Alpin Ogilvie, B.Eng., (Mining), asst. supt. Plant No. 1, Canada Cement Co., Ltd., Montreal, Que.

Fitzpatrick, Louis Fairlie, B.Eng., (Chem.Engrg.), McGill, plant operations dept., Shawinigan Chemicals Ltd., Shawinigan Falls, Que.

Gow, Peter Williamson, Woolwich Polytechnique, chief drftman., Canadian Allis-Chalmers Ltd., Montreal, Que.

Harris, Jack Edward, B.A.Sc., M.A.Sc., (chemistry & Physics), British Columbia, works engr., Dow Chemical of Canada Ltd., Sarnia, Ont.

Ligertwood, Henry Cormack Grant, B.Sc., (Civil Engrg.), Manitoba, constrn. engr., Winnipeg Electric Co., Seven Sisters Falls, Man.

Mackenzie, Kenneth Charles Macgregor, steam generator supt., Restigouche Co., Campbellton, N.B.

Mann, Clarence W. J., B.A.Sc., M.A.Sc., (Chem.Engrg.), British Columbia, process engr., Imperial Oil Limited, Sarnia, Ont.

Marshall, Edgar Albert, Major, B.Sc., (Civil Engrg.), Manitoba, Canadian Staff College, Royal Military College, Kingston, Ont.

McInerney, Harold Owen, B.Sc., (Civil Engrg.), New Brunswick, asst. genl. supt., Riverbend mill, Price Bros. & Co., Ltd., Riverbend, Que.

Parr, John Vernon, B.A.Sc., (Elect.Engrg.), Toronto, jr. project engr., Canadian Industries Ltd., Windsor, Ont.

Patton, George Lloyd, B.Sc., (Elect.Engr.), Manitoba, jr. engr., power plant, City of Winnipeg Hydro Electric System, Winnipeg, Man.

Scaife, James Finley, B.Sc., (Civil Engrg.), Manitoba, instru'man. highway branch, Dept. of Public Works, Manitoba, Winnipeg, Man.

Sellers, Ernest George, B.Sc., (Elect.Engrg.), Queen's, asst., mech. supt., Federal Grain Co., Ltd., Fort William, Ont.

Sobolewski, Jerzy Josef, Mech. Engr., Politechnika Lwowska, Poland; Elect. Engr., Institut Poly., Grenoble, France; design engr., power plant section, Canadair Ltd., Montreal, Que.

Swick, Michael Victor, B.A.Sc., (Mech. Engrg.), Toronto, mech. engr., engrg. dept., Hamilton works, Steel Co. of Canada, Hamilton, Ont.

Warner, Frederick Richard, B.A.Sc., Toronto, asst. engr., Dept. of Transport, Ontario-St. Lawrence Canals, Cornwall, Ont.

Wood, Thomas Archibald, inspector of boilers & mach., and engr. surveyor, Government of British Columbia, Vancouver, B.C.
Zolkiewicz, Zygmunt Julian, engr. Diplom., Politechnika Lwowska, Poland, structl. engr., engrg. dept., Canadian Industries Limited, Montreal, Que.

Juniors

Belshaw, Frank, B.A.Sc., (Mech.), Toronto, dftsman., Imperial Oil Limited, Sarnia, Ont.
Boa, Gilmour Stuart, Toronto, B.A.Sc., (Civil Engrg.), Toronto, jr.engr., design dept., Dominion Bridge Co., Ltd., Toronto, Ont.
Clark, Stuart, B.Sc., (Mech.Engrg.), Queen's, process engr., Thunder Bay Paper Co., Port Arthur, Ont.
Deschenes, Albana Miville, B.Eng., (Civil), McGill, design work, Robt. A. Rankin Co., Ltd., Montreal, Que.

Affiliate

Devall, Douglas Harold, B.A., McMaster Univ., chemist i c of lab., ore plant No. 1, Aluminum Co. of Canada, Arvida, Que.

Transferred from the class of Junior to that of Member

Alton, William, Major, R.C.C.S., B.Sc., (Physics), Queen's, Chief Instructor, Royal Canadian School of Signals, Vimy Barracks, Kingston, Ont.
Bridge, David E., B.A.Sc., Toronto, director academic training, Hamilton Tech. Institute, Hamilton, Ont.
Cummings, George Williams, B.Eng., (Civil), Nova Scotia Tech., consultg. engrg., St. John's, N'fld.
Eckenfelder, George Victor, B.Sc., (Civil), Alberta, res. engr., i/c constrn., Barrier hydro-elect. development, Calgary Power Ltd., Seebe, Alta.
Farmer, Philip John, B.A.Sc., (Elect.), British Columbia, mgr., order and estimating dept., English Electric Co. of Canada, Ltd., St. Catharines, Ont.
Gordon, John Edward, B.Sc., (Mech.), Queen's, chief engr. & asst. plant mgr., Whitchall Machine & Tools Ltd., Galt, Ont.
Johnston, William David, B.A.Sc., (Civil), Toronto, chief engr., Ideal Welding Co., Ltd., Toronto, Ont.
Meredith, William Ralph, B.Sc., (Mech.), Queen's, patent engrg. consultant, Goulding, MacTavish, Watt, Osborne & Henderson, Ottawa, Ont.
Miller, John Leonard, B.Sc., (Civil), Saskatchewan, chief structl. dftsman., Arthur Pearson, consultg. engr., Vancouver, B.C.
Taylor, Bruce Smith, B.Sc., (Chem.Engrg.), Queen's, investigating engr., Industrial Development Bank, Vancouver, B.C.

Transferred from the class of Student to that of Member

Baird, Samuel L., B.Eng., (Chem), McGill, asst. to sr. research engr., Consolidated Mining & Smelting Co. of Canada, Trail, B.C.
Wong, P. Huey, B.Eng., Kuo-Min Univ.; S.M., (Civil Engrg.), M.I.T., instructor at McGill Univ., Montreal, Que.

Transferred from the class of Student to that of Junior

Belanger, Cecilien, B.A.Sc., (Met.), Laval, chief inspectr., The Central Mortgage & Housing, Quebec, Que.
Ott, Helmuth George, B.Eng., McGill, engr., Gunite & Waterproofing Ltd., Montreal, Que.

Admitted as Students

Corey, Bruce Milestone, (N.S.Tech.), Yarmouth, N.S.
Dimentberg, Myer, (Manitoba), Winnipeg, Man.
Hall, Robert Douglas, (Alberta), Edmonton, Alta.
Higgins, Brian Edmond, (Nova Scotia Tech.), St. John's, N'fld.
Kerby, John Brant, (Alberta), Edmonton, Alta.
Kerr, Byron Thomas, (Nova Scotia Tech.). Halifax, N.S.
Lane, Alan Geoffrey, (McGill), 3506 University St., Montreal, Que.
MacBride, James David, (Queen's), St. Stephen, N.B.
McMurtry, William Denton, (Toronto), 11 MacLennan Ave., Toronto, Ont.
Nishikawara, Kenneth K., (Toronto), Beamsville, Ont.
Nykyforuk, Michael, (Saskatchewan), Kingston, Ont.
Roberts, Robert John, (McGill), 6695 Sherbrooke St., W., Montreal 28, Que.
Scouler, Daniel, (Nova Scotia Tech.), Armdale, N.S.
Tapley, Frederick Mark, (Manitoba), Winnipeg, Man.
Tutecky, John, (Toronto), Terrace Bay, Ont.

By virtue of the cooperative agreements between the Institute and the associations of professional engineers, the following elections and transfers have become effective:

SASKATCHEWAN

Members

Davis, Rees William, B.Sc., (Elect.), Univ. of Utah, plant supt., Churchill River Power Co., Ltd., Island Falls, Sask.
Malko, Peter Frederick, B.Sc., (Chem.Engrg.), Saskatchewan, Malko Chemical Products, Saskatoon, Sask.
Smith, W. D., Box 196, Prince Albert, Sask.

Students

Armstrong, George Merlin, Univ. of Saskatchewan, Saskatoon, Sask.
Kot, Steven Donald, Univ. of Saskatchewan, Saskatoon, Sask.

Junior to Member

Leach, Trowson Alfred James, B.Sc., (Civil Engrg.), Saskatchewan, res. engr., Saskatchewan Dept. of Highways, Saskatoon, Sask.
Tomkins, Robert Vernon, B.Sc., (Chem.), Saskatchewan, Dept. of Natural Resources, Regina, Sask.

Student to Junior

Daniels, Ray Percy Levi, B.Sc., (Civil Engrg.), Saskatchewan, c/o City Engineering Adm., Yorkton, Sask.
Funk, John Abram, B.Sc., (Elect.Engrg.), Manitoba, instructor, Univ. of Saskatchewan, Saskatoon, Sask.

ALBERTA

Member

Hawkins, Leonard Karl, resident engr., Dept. of Transport, Edmonton, Alta.

Junior

Copp, Stanley Seymour, B.A.Sc., (Civil), British Columbia. sanitary engr., Dept. of National Health and Welfare, Edmonton, Alta.

Junior to Member

Hislop, Richard Hamilton, B.Sc., (Civil); M.Sc., (Soil Mechanics), Univ. of Alberta; instructor, civil engrg. dept., Univ. of Alberta, Edmonton, Alta.

Student to Member

Sadler, Wilfred Robertson, res. highway engr., Province of Alberta, Dept. of Public Works, Edmonton, Alta.

NEW BRUNSWICK

Junior to Member

Holohan, Edward, B.Sc., (Elect.Engrg.), New Brunswick, res. engr., airport constrn., Dept. of Transport, Moncton, N.B.

NOVA SCOTIA

Members

Bernard, Anthony Joseph, B.Sc., (Civil), Nova Scotia Tech., Works Officer, R.C.E., Halifax, N.S.
Morgan, Ralph Taylor, B.Sc., McMaster Univ., plant engr., Zwicker & Col., Lunenburg, N.S.
Murphy, Ernest Paul, Lieut. (E)., R.C.N., B.Eng., (Mech.), Nova Scotia Tech., Officer I/C design & dfting., Dept. of National Defence, R.C.N. Armament Depot, Dartmouth, N.S.
Reardon, James Edward, B.Eng., Nova Scotia Tech., Public Service Commission, Halifax, N.S.

Junior to Member

Vaughan, Joseph Philip, B.Eng., Nova Scotia Tech., res. engr., Dept. of Highways & Public Works, Halifax, N.S.

QUEBEC

Members

Bull, Victor George, chief engr., Electric Tamper & Equipment Co. of Canada Ltd., Montreal, Que.
Hudston, David N., Lachine, Que.
Ord, Lewis Redman, B.A.Sc., Toronto, sr. industrial engr., Stevenson & Kellogg Ltd., Montreal, Que.

Personals

News of the Personal Activities of members of the Institute

J. E. Cranswick, M.E.I.C., is elected chairman of the Edmonton Branch of the Institute. He is from Moore Park, Man., a B.Sc. in electrical engineering of the University of Manitoba, class of 1929. He worked for six months with Hudson's Bay Mining and Smelting in Winnipeg as a transmission line inspector, after which he joined Canadian Westinghouse Company Limited, following the apprentice course. He was appointed to the sales office in Edmonton, Alta., in 1931, to the position of salesman in the Edmonton territory in 1935, and to that of sales engineer in the Calgary territory in 1941. He was named sales engineer in charge of the Edmonton Branch in 1942 and in 1945 was made branch manager.

P. A. Dupuis, M.E.I.C., has been elected chairman of the Quebec Branch of the Institute. He was born at St. Roch des Aulnets, Co. l'Islet, Que., and studied at Levis, Que., and at Ecole Polytechnique, Montreal. After graduation in 1921 with a B.A.Sc. degree in civil engineering, he joined the Department of Public Works at Quebec as an engineer. He was appointed senior engineer in 1929. He also acted for many years as consulting engineer to the Maple Sugar Producers Association. His present position with the provincial Department is that of assistant chief engineer.

D. G. Geiger, M.E.I.C., is the new chairman of the Toronto Branch of the Institute. He is from Ottawa, a graduate of Queen's University with B.Sc. degrees in electrical and mechanical engineering, received in 1922 and 1923. He remained at the University after graduation as a demonstrator in electrical engineering for two years, and in 1924 joined the transmission engineering department of the Bell Telephone Company of Canada at Toronto. He returned to Queen's as a lecturer in 1926. There he was in charge of broadcasting and operating station CFRC and redesigned and rebuilt the broadcasting equipment. He rejoined the Bell Telephone Company two years later, going to the transmission department at Montreal, and transferred in 1930 to his present position as transmission engineer at Toronto. Mr. Geiger is a member of the Council of Queen's University, and has been a member of the national committee of communication of the American Institute of Electrical Engineers. He was recently elected vice-president of the A.I.E.E.

E. B. Broadhurst, M.E.I.C., the new secretary-treasurer of the Kootenay Branch of the Institute, war born in Salford, England. He studied at schools in Trail, B.C., and attended the University of B.C. He has been with the Consolidated Mining and Smelting Company since 1934, beginning as an apprentice draughtsman. He was designing draughtsman from 1938 until 1945, when he was loaned for several months to Defence Industries Limited. On his return he was appointed maintenance engineer for the lead smelting department of the company at Trail. He is a registered professional engineer.

R. T. Harland, M.E.I.C., recently appointed secretary-treasurer of the Winnipeg Branch of the Institute, is an electrical engineer with the City of Winnipeg Hydro Electric System. Born in Winnipeg, he holds a B.Sc. degree from the University of Manitoba, and received his M.Sc. degree in electrical engineering from Massachusetts Institute of Technology, Cambridge, Mass., in 1940. He was with the city of Winnipeg Hydro from 1940 until 1942, when he joined the R.C.A.F. as a radar officer. He was engaged in radar research, and was sent to Washington with the R.C.A.F. section of the Canadian Joint Staff. He returned to civil life in 1946.

Dr. Otto Holden, M.E.I.C., was appointed in March last to be assistant general manager, engineering, for the Hydro Electric Power Commission of Ontario. With some thirty-five years of service with the Commission, he was chief hydraulic engineer for some years prior to his recent appointment. Dr. Holden was chairman of the Toronto Branch of the Institute in 1936, and a member of Council of the Institute in 1938 and 1939. He has been president of the Royal Canadian Institute, and of the Engineering Alumni Association of the University of Toronto.

John Dibblee, M.E.I.C., became manager of personnel for the Hydro Electric Power Commission of Ontario in April. During his thirty years with the Commission he has been station design engineer, district operating engineer for the eastern Ontario system, general superintendent of the Niagara Falls District, assistant chief operating engineer and assistant chief engineer. Since 1945 he had been chief engineer, operations.

W. P. Dobson, M.E.I.C., director of research for the Hydro Electric Power Commission, joined the commission as assistant engineer in charge of the laboratory in 1914. He has held the presidency of the Dominion Council of Professional Engineers and the Canadian Council of Professional Engineers and Scientists. He has been chairman of the Approvals Administrative Board of the Canadian Standards Association since 1940, and a member of the executive committee of that association since 1936.

M. J. McHenry, M.E.I.C., is the new director of consumer services for the Hydro Electric Power Comission of Ontario. He came to the Commission in 1938 as director of sales promotion. He is a past president of the A.M.E.U., and the Electric Club of Toronto, and a past vice-president of the American Institute of Electrical Engineers. He is now president of the Electric Service League of Ontario, a director of the A.I.E.E., and a vice-president of the Canadian Electrical Council.

Robert Blais, M.E.I.C., the former assistant chief engineer of the Department of Public Works of Canada, is appointed chief engineer. He has been with the department since his graduation from Ecole Polytechnique in Montreal in 1912. He was assistant engineer in the district office at Ottawa until his appointment as senior assistant engineer in 1921. He went to the chief engineer's branch in 1936, was promoted to the position of superintending engineer in 1941, and to assistant chief engineer in 1943.

P. E. Doncaster, M.E.I.C., retired officially in July as Winnipeg district engineer for the Department of Public Works of Canada. He entered the department in 1908 and has served in districts from Prince Rupert, B.C., to Fort William, Ont. In May 1943, after serving with the Department of Munitions and Supply at Dominion Magnesium Limited at Haley, Ont., and for Wartime Metals Corporation and the Polymer Corporation at Sarnia, Ont., on loan from the Department, he took over his duties at Winnipeg, where he remained until his retirement from the public service. He was a Councillor of the Institute in 1939-40.

Dr. Paul E. Gagnon, M.E.I.C., the recently elected president of the Chemical Institute of Canada, is director of the department of chemical engineering of Laval University, Quebec. The election took place at the recent annual conference of the Chemical Institute at Banff, Alta.

Noel J. Ogilvie, M.E.I.C., has retired as dominion geodesist and Canadian International Boundary Commissioner for the Department of Mines and Resources. He has been concerned with government geodetic surveying for many years and has represented the National Committee of Canada of the International Union of Geodesy and Geophysics. He was named in 1931 international boundary commissioner by the British Government to aid in arranging matters pertaining to the United States-Canada borderline. He was also active in the surveying and mapping division of the American Society of Civil Engineers.

J. L. Rannie, M.E.I.C., has been appointed dominion geodesist in the Geodetic Service of Canada, Surveys and Engineering Branch of the Department of Mines and Resources. He has served with the Geodetic Service and the International Boundary Commission for some forty years. He is a dominion land surveyor, a Quebec land surveyor, and a dominion topographical surveyor. In 1943 he was appointed assistant dominion geodesist. Mr. Rannie is a past-chairman of the Ottawa Branch of the Institute, and a past-councillor of the Institute. He is a past-president of the Canadian Institute of Surveyors, and past vice-president of the Professional Institute of the Civil Service of Canada.

Graham Kearney, M.E.I.C., manager at Montreal for English Electric Company of Canada Limited, is retiring after 45 years in the electrical industry. He joined the company in 1934, coming to Montreal from Vancouver where he was a member of the firm of Sawford and Kearney. His career included service with the Canadian General Electric Company at Prince Rupert, Victoria, Vancouver and Montreal, and with Anderson Meyer and Company Limited in charge of sales at the branch offices at Tientsin, Canton and Hongkong, China. While in

China he was professor of electrical engineering at the Tangshan College of the Chiao Tung University from 1917 to 1919.

G. R. Langley, M.E.I.C., of Peterborough, has received the honorary degree of doctor of science from Union College, Schenectady, N.Y., from which college he was graduated in 1903. He has been chief engineer of Canadian General Electric at Peterborough for several years, and has been responsible for the selecting and training of engineers for the entire Canadian Company.

A. Newland, M.E.I.C., has been appointed by Ruston and Hornsby Limited of Lincoln, England, to be their resident representative for North America. He will also represent Davey, Paxman and Company Limited of Colchester, an associated company. Mr. Newland will shortly open an office in Toronto to work in conjunction with the company's Canadian distributors.

J. L. E. Price, M.E.I.C., is the recipient of the highest award of the Canadian Legion, its Medal of Merit. Presentation was made at the recent annual convention of the Quebec Command in Montreal in tribute to his outstanding work in helping to solve the veteran's housing problem. Mr. Price is president and general manager of J. L. E. Price and Company Limited, Montreal.

Gerald S. Roxburgh, M.E.I.C., of Winnipeg, Man., has returned to his practice as patent attorney, after having served during the war years at Winnipeg as regional representative of the Wartime Bureau of Technical Personnel for the Dominion Government.

William Storrie, M.E.I.C., Toronto consulting engineer, was announced winner recently of the 1947 Kenneth Allen Award for outstanding service in the sewerage and sewage treatment works field. The announcement of the triennial award was made by the Canadian Institute of Sewage and Sanitation for the donors, the Federation of Sewage Works Associations.

George E. Treloar, M.E.I.C., chief engineer of the Sarnia Bridge Company, Limited, was elected president of the Canadian Institute of Steel Construction Incorporated, at the seventeenth annual meeting in Montreal.

A. G. S. Murphy, M.E.I.C., is now port manager at Montreal Harbour, for the National Harbours Board. He had been at Montreal Harbour from 1937 to 1941, when he was transferred by the Board to Ottawa.

Clyde F. Cameron, M.E.I.C., was recently appointed manager of Maritime Steel and Foundries, Limited, New Glasgow, N.S., succeeding his late father as operating head of the firm. First associated with the company in 1936, he served during the war years with the R.C.E. Retiring in 1945 with the rank of major, he returned to the company as assistant general manager.

H. S. Milne, M.E.I.C., was transferred in March to the National Research Council Operating Section of the Chalk River Atomic Energy Project, with the position of assistant superintendent of the mechanical and power services branch. In April he was promoted to superintendent of the same Branch. He had been employed as resident engineer on the project for Defence Industries Limited.

J. H. McIntosh, M.E.I.C., returned to England recently from South Africa. He expects to take up residence in South Africa, and will be works director for White S. A. Portland Cement Company Limited in Johannesburg. He had been works manager for Portland Cement Manufacturers Limited, Northfleet, Kent, England.

I. J. Macpherson, M.E.I.C., engineer of the Howard Smith Paper Mills, Cornwall, has been loaned to the Alliance Paper Company Limited, a division of the company in Merritton, Ont., to take on the duties of mechanical maintenance superintendent.

A. F. M. M. S. Huda, M.E.I.C., has received the degree of master of science in civil engineering from the University of Toronto and is employed by the Department of Highways in Toronto. He was an India Government overseas scholar at the University.

Maurice Giroux, M.E.I.C., has severed his connection with C. Howard Simpkin Limited, to enter into partnership with J. H. Laframboise, Montreal real estate valuator. The firm will specialize in valuation of real estate, industries, and public utilities.

P. M. Hopkins, M.E.I.C., has received the bachelor's degree in civil engineering from McGill University in May, and has entered the employ of the Saguenay Power Company Limited at Isle Maligne, Que.

Dugald Cameron, M.E.I.C., has established a practice as engineering industries consultant in Toronto, Ont., under the firm name of Dugald Cameron Associates. He had been since 1945, assistant general manager and chief) engineer for Hall Machinery of Canada Limited, Sherbrooke, Que.

A. C. Northover, M.E.I.C., development and promotion consultant of Toronto, Ont., has had his thesis for the professional degree of civil engineer accepted by the board of examiners and the faculty of the University of Toronto.

W. E. Seely, M.E.I.C., formerly with C. R. Turner and Company Limited, Montreal, has accepted a position with the British American Oil Company at Montreal East, Que.

J. F. Osborn, JR.E.I.C., is the new chairman of the Peterborough Branch of the Institute. Born at Montmartre, Sask., he studied at the Universities of Saskatchewan and Manitoba, receiving a B.Sc. in electrical engineering from the latter in 1936. He joined the Canadian General Electric Company's test department in Peterborough that year, and was made foreman of the department in 1938. He was appointed to his present position as assistant engineer of the industrial control engineering department in 1939.

J. M. King, JR.E.I.C., has been appointed secretary-treasurer of the Peterborough Branch of the Institute. A metallurgist with the Canadian General Electrical Company in Peterborough he is a graduate of the University of Toronto with a B.A.Sc. degree received in 1940. He went to his position with Canadian General Electric after graduation, and is in charge of control of metallic materials and metallurgical processes.

R. A. Muller, JR.E.I.C., the newly appointed secretary-treasurer of the Toronto Branch of the Institute, is a graduate of the University of Toronto, class of 1943, with a B.Sc. degree in engineering physics. He joined the R.C.N. as a sub-lieutenant, serving overseas. Released in 1946 as a lieutenant (E) he returned to his native Toronto, where he joined the transmission engineering department of the Bell Telephone Company of Canada Limited.

R. W. McNally, JR.E.I.C., formerly assistant engineer in the Toronto office of Mathews Conveyor Company Limited, has been transferred to the Hamilton Office. He joined the company this year as service engineer on release from the R.C.E.M.E. as a lieutenant.

John D. Abell, JR.E.I.C., was promoted to the position of works engineer by the International Harvester Company, Hamilton, Ont. He went to the company in 1945 as a mechanical engineer.

Percy Codd, JR.E.I.C., is employed by the Dominion Magnesium Company Limited, Haley, Ont., as research chemist.

E. C. Reid, JR.E.I.C., has joined the Aluminum Company of Canada at Kingston, Ont. He was with the Canadian Gypsum Company Limited at Hillsboro, N.B.

H. M. Coverdale, JR.E.I.C., who has completed the requirements for his masters degree in mechanical engineering at the Massachusetts Institute of Technology, Cambridge, Mass., is now in Trail, B.C., employed by the Consolidated Mining and Smelting Co. Ltd.

Lloyd A. Pattison, S.E.I.C., is at Cobalt, Ont., with the Hydro-Electric Power Commission of Ontario.

Lance W. Ward, S.E.I.C., is employed as plant engineer for the Canadian Bridge Company at Walkerville, Ont.

W. J. Anderson, S.E.I.C., recently accepted a position with the township of Etobicoke, Ont., as an assistant engineer. He was previously with the Bell Telephone Company at Montreal.

J. C. Finch, S.E.I.C., has accepted a position with the Quebec Hydro Electric Commission at Montreal. He received his bachelor of engineering degree from McGill University at Montreal this year.

J. L. Halter, S.E.I.C., is with the Brompton Pulp and Paper Company Limited in Red Rock, Ont., as electrical designer. He was formerly an electrical engineer in the mechanical division of the Massey-Harris Company Limited, Toronto, Ont.

D. D. Love, S.E.I.C., is plant engineer in charge of manufacturing control for Moore Business Forms Western Limited, at

Winnipeg, Man. He received his bachelor of engineering degree (electrical) this year from McGill University.

R. S. Kittlitz, S.E.I.C., is in Bogota, Colombia S.A., in the employ of the Tropical Oil Company geophysical department. He had been in Calgary, Alta., with Imperial Oil Limited.

A. S. Miller, S.E.I.C., is established at Fort William, Ont., in the employ of the Abitibi Power and Paper Company.

J. J. Normand, S.E.I.C., has received his bachelor of engineering degree (mechanical) from McGill University, Montreal, and is in the employ of the Laprairie Company Inc., at Laprairie, Que.

R. J. Smith, S.E.I.C., formerly of Lakeview, Ont., is in Barranca, Bermeja, Colombia, S.A., in the employ of the Tropical Oil Company.

R. G. Anderson, S.E.I.C., is following the training course of the Canadian Westinghouse Company Limited at Hamilton, Ont. He received his B.Sc. degree in electrical engineering from the University of Manitoba this year.

David Feldman, S.E.I.C., is at Smiths Falls, Ont., with the Frost and Wood Company Limited.

Leo Scharry, S.E.I.C., has accepted a new position as sales engineer with Sangamo Company Limited, Montreal. He was formerly with Leblanc and Montpetit, Montreal consulting engineers.

Obituaries

The sympathy of the Institute is extended to the relatives of those whose passing is recorded here.

Baron Boris de Hueck, M.E.I.C., of Cornwall, Ont., and Montreal, died on June 10th, 1947, in Montreal after two months' illness. He was born at St. Petersburg, Russia, in 1899, received his early education at the Emperor Alexander Military College and studied at the Polytechnic Institute of Riga, receiving a B.Sc. in 1913. While serving at the University as assistant professor of mathematics for two further years, he was active in a consulting practice at St. Petersburg. He saw military service from 1915 to 1919, first as a major with the Imperial Engineering Corps of the 1st and 5th Russian armies, and later as a major with the British Expeditionary Forces at Murmansk. From 1919 to 1921 he was a technical advisor with the Russian Embassy in London, England.

He then came to Canada and was employed first as an engineer with the Toronto Carpet Company and the Barrymore Cloth Company. Two years later he established a consulting practice with various industrial contacts in Ontario, Quebec, and the U.S.A., and in 1926 entered Stuart James and Cook Inc., New York, in an engineering capacity, becoming Montreal manager for that company in 1928. He then entered the Canadian National Railways in Montreal as an engineer, remaining three years, and joined the Canadian Cottons Limited, Montreal, as chief engineer in 1934. In that position he was located at Cornwall for some years before his death.

Baron de Hueck joined the Institute in 1944 as a Member, was appointed councillor representing the Cornwall Branch at its formation in 1946, and resumed that office for the 1947 term.

C. R. Murdock, M.E.I.C., of Kapuskasing, Ont., died on May 4th, 1947, after a short illness. Civil engineer for the Spruce Falls Power and Paper Company there, and engineer adviser to the town of Kapuskasing, Mr. Murdock had been a resident for nineteen years.

Born in Brampton, Ont., in 1880, he attended the University of Toronto, graduating in 1906 with a B.A.Sc. degree. He worked first as rodman for Canadian National Railways and as transitman on construction for the Canadian Northern Railway at Cap Rouge, Que. Next he was transitman with the Canadian Pacific Railway at North Bay, Ont., on maintenance of way, and in 1909 he worked with Thos. Fawcett, dominion land surveyor, in Saskatchewan and Manitoba. The next year he joined Chipman and Power, Winnipeg engineers, and was resident engineer at Dauphin, Man., Weyburn, Sask., and High River, Alta. From 1923 he was town engineer at Timmins, Ont., until 1928 when he went to Kapuskasing as town engineer and townsite manager for the Spruce Falls Power and Paper Company.

Mr. Murdock joined the Institute in 1912 as an Associate Member, becoming a Member in 1940, and being awarded life membership in January 1947. He was also a member of the Association of Professional Engineers of Ontario.

Brig.-General H. T. Hughes, M.E.I.C., of Victoria, B.C., died on June 4th, 1947. He was born in London, England in 1870. While articled to Messrs. Alexander and Gibson, architects and surveyors, in London, he studied building construction for three years at the Polytechnic in London. He came to Canada some time later and worked first in Winnipeg as assistant to S. F. Peters, architect, and later as assistant to Geo. Browne, architect.

He joined the Canadian Pacific Railway in 1896 as a draughtsman, and remained on engineering work for the railway until 1900 in Alberta, Ontario and Manitoba. From 1900 to 1903 he was assistant to the chief engineer at Quebec and Lake St. John, Que., for the Great Northern Railway. Then followed three years of private practice in Quebec City.

He joined the R.C.E. as a subaltern in 1904, and was camp engineer at Valcartier, Que., in 1914. He commanded the Royal Engineers, Second Canadian Division in 1918-19, after which he was appointed chief engineer of the Canadian Battlefields Memorial Commission, supervising memorials in eight cities of France and Belgium, including the Vimy Memorial. He was awarded the C.M.G., and D.S.O.

Brig.-General Hughes joined the Institute as an Associate Member in 1899, transferred to Member in 1925, and was awarded Life Membership in 1941.

News of the Branches

Activities of the Twenty-eight Branches of the Institute and abstracts of papers presented

EDMONTON BRANCH

W. W. Preston, Jr.E.I.C. - *Secretary-Treasurer*

A challenging analysis of **Engineering Organization in Canada** from early times to date, was presented by J. G. Dale, registrar of the Association of Professional Engineers of Alberta, in an after dinner speech at the Annual Meeting of the Edmonton Branch on April 22nd, in the Macdonald Hotel.

Mr. Dale reviewed the development of various engineering and associated organizations in Canada and outlined their objectives. He noted that there are three fundamentally different types of organization, (1) societies which engineers and scientists join *voluntarily* for technical and social activity, e.g. the E.I.C.; (2) provincial professional associations constituted with licensing and policing power by provincial acts, which an engineer *must* join to practice his profession, and (3) collective bargaining groups which only employee-engineers may join for the purpose of improving their salaries. The three types perform different functions. One does things which the others cannot. For example, collective bargaining cannot be handled by the voluntary societies or the associations since their memberships include employers who, according to legislation, must be excluded from bargaining agencies.

In his review of the development of engineering organizations in Canada, the speaker stated that the pioneer voluntary organization was incorporated by Royal Sanction in 1887 with the name, "The Canadian Society of Civil Engineers". Its membership was civilian in contrast with military and was not limited to civil engineers, so its name was changed in 1918 to "The Engineering Institute of Canada". Through the leadership of this organization, provincial associations of professional engineers were formed, the first being established in Quebec in 1898. All provinces except Prince Edward Island now have Associations. To co-ordinate these bodies, an organization known as the Dominion Council of Professional Engineers was formed in 1936. It was not till 1938 that the first co-operative agreement was made between the Engineering Institute and an association (Saskatchewan). The other Associations with the exception of British Columbia, Manitoba and Ontario now have agreements with the Institute.

A broader co-ordination of engineering and other organizations came into being in 1944 when representatives of fourteen engineering and scientific bodies united to draft representations concerning Order-in-Council PC 1003, relative to collective bargaining for the professions. The success of this group, later known as the Committee of Fourteen, encouraged the creation of the Canadian Council of Professional Engineers and Scientists. This organization consists of a chief officer of each of several participating societies and includes agriculturalists, architects, chemists, dietitians, engineers, foresters, physicists and others. The council aims to deal with matters which are national in scope and which affect the interests of professional engineers and scientists. The Engineering Institute co-operated in the Committee of Fourteen and has proposed a conference committee of the interested organizations as a less costly and more practical alternative to the C.C.P.E. & S. The Institute does not support the new council.

Mr. Dale stressed the need for a co-ordinating body, and advanced several reasons. Different organizations with common interests may achieve a common purpose more efficiently. Negotiations with the various societies can be more effectively carried out with the organization of representatives rather than with each society individually. Legislation proposed by some of the societies may develop into one act for all engineers and scientists. A composite technical journal would be a worthwhile publication. Overhead could be reduced by having a common secretariat and library, and thus make it possible for juniors to be associated with organizations which they could not otherwise afford to join.

In conclusion the speaker urged the necessity of carefully considering the organizational problems of the technically trained groups in Canada.

In the business portion of the Annual Meeting, the officers and committee chairmen reported their activities for the Branch year, May 1st 1946 to April 30th 1947, as follows: councillor's report by C. W. Carry, chairman's report by J. W. Porteous, secretary-treasurer's report by W. W. Preston, Membership Committee report by T. W. Dalkin, Programme Committee report by J. E. Cranswick, auditor's report (re calendar year 1946) by D. Ross, Rehabilitation Committee report by E. H. Wright, Young Engineer's Committee report by R. E. Phillips, report of a special committee on Foundation Soils in the Edmonton district by R. M. Hardy, and report of the Committee on Branch Nominations by F. R. Burfield.

The election of new officers followed, and at the conclusion of business the members rallied for a "smoker" at which refreshments were provided. The attendance, a new high for annual meetings, was 58.

HAMILTON BRANCH

L. C. Sentance, m.e.i.c. - - - *Secretary-Treasurer*
I. M. Macdonald, jr.e.i.c. - *Branch News Editor*

The Annual Joint Meeting of the American Institute of Electrical Engineers, Toronto Section and Hamilton Sub-section, and the Hamilton Branch of the Institute was held on Friday, April 18th, 1947, at the Westinghouse Auditorium. E. G. Wyckoff, branch chairman, opened the meeting, and called on A. Frampton, of the Toronto Section, to preside. Approximately 150 members and guests were in attendance.

The speaker was introduced by A. A. Moline. He was Mr Edward W. Beck, manager of the Lightning Arrester Section of the Westinghouse Electric Corporation, East Pittsburgh. He chose to speak on his recent work, **Lightning Protection of Industrial Plants.**

Lightning arises because cloud particles become charged, giving rise to a difference in potential between cloud and earth. Air below the cloud becomes ionized, and a discharge takes place from the cloud to the earth. Objects on the earth, such as tall buildings, trees, etc., near this discharge attract it towards themselves, and the stroke travels through these objects to the ground. If the object is a building with considerable metal in its structure, the lighting encounters little resistance and passes freely to ground. A tree, or unprotected masonry stack, however, offers a large resistance, and the resulting bursting effect can demolish the structure.

Industrial plants should be protected in two ways: the building itself should allow the lightning a free path to ground, and the equipment within the plant should be provided with lightning arresters. Buildings are easily protected by lightning rods, and metal structures need very little protection. Equipment can be protected by putting lightning arresters in power lines as near each machine as possible, with an arrester between the last machine on the line and ground. Generally speaking, an unprotected plant will be struck by lightning once in twenty-five years; protection with lightning arresters reduces the possibility to one strike in 10,000 years. The cost of protection against lightning is less than one half of one percent of the cost of the equipment being protected.

Slides shown throughout the talk illustrated Mr. Beck's remarks, and gave the audience a clear conception of his ideas.

At the conclusion of a lively discussion period conducted by Mr. Frampton, Neil Metcalf moved a vote of thanks to Mr. Beck for his interesting and informative talk.

The presentation of engraved certificates to Messrs. Haughton, Galloway, Cook and Freeman for their papers presented at the Branch Student and Junior meeting in March concluded the business of the meeting, after which those present enjoyed refreshments provided by the Canadian Westinghouse Company.

OTTAWA BRANCH

C. G. Biesenthal, jr.e.i.c. - *Secretary-Treasurer*
R. C. Purser, m.e.i.c. - - *Branch News Editor*

At a noon luncheon meeting on May 8, Edouard Fiset, principal associate to Jacques Greber, author of Greater Ottawa's Master Plan, addressed the Ottawa Branch on the subject of **Town Planning.** D. E. Kennedy of the Management Committee presided in the absence of Chairman Maj.-Gen. G. R. Turner. The speaker was introduced by Frederic Alport and thanked by the chairman who also called upon Jacques Greber, who spoke briefly.

Mr. Greber's definition of town planning, said Mr. Fiset, is "the technique of social order". It is much more than combining built up areas and open spaces, in designing highways and bridges, and in landscaping parks and parkways.

It provides for the welfare of the people through planning and proper regulations. It aims to create pleasant and comfortable living quarters, to facilitate civic services and transportation, to provide for a well-rounded community life, to protect and enhance the natural character and beauty of the land, and to ensure the continuity of its use. It is thus a guarantee for the good functioning of the industrial life, a safeguard of the health conditions, and a protection against fluctuations in land or property values.

No person can solve to the last detail all problems connected with town planning. It requires team-work with a co-ordinator in charge who should be gifted with the priceless capacity of creating. There has been much discussion about the exact qualifications desired in such a co-ordinator.

Should the town planner be basically a sociologist, an administrator, or a professional man such as an engineer or an architect? No doubt he should have a broad knowledge of sociology as well as administration, whether civic or otherwise, of engineering and architecture not excluding various sciences and arts in direct relation with town planning. He should also have refined aesthetical ideals.

A technician is too often a specialist and might be inclined to place too much stress on the specialized branch of science in which he had been trained, said Mr. Fiset. The town planner must collect all points of view in order to propose an equitable solution to any problem. Engineering and architecture appear basic to the new science of town planning. The co-ordinator of a project must have a broad general knowledge of these and a sense of balance and proportion. The objective is rather to prevent unsuitable development than to cure civic ills after they have occurred.

Mr. Greber in his brief remarks told something of his experiences in Rouen, in Switzerland, and in Philadelphia in the course of his town-planning career. He said also that success in any town-planning project is very much better when the engineer and architect start to collaborate at the very beginning and work together.

SAGUENAY BRANCH

J. E. Dyck, m.e.i.c. - - - *Secretary-Treasurer*

Junior Section

T. T. Anderson, jr.e.i.c. - *Secretary-Treasurer*

A meeting of the Junior Section of the Saguenay Branch was held in the banquet room of the Saguenay Inn on Wednesday May 21st at 8:15 p.m.

J. T. Madill, chairman of the Junior section introduced the speaker, F. G. Barker.

His talk included a discussion of the operations of the Micronizer, Sulphuric Acid and Aluminum Sulphate plants in the Arvida Works of the Aluminum Company of Canada, Limited.

The micronizer plant contains the only micronizer reduction mills installed in Canada. These mills are used for pulverizing various materials and the plant at Arvida produces micronized DDT powder, micronized wettable sulphur powder and micronized cryolite. These products are agricultural insecticides and are sold under the Green Cross labels of Sherwin-Williams Company of Canada Ltd. Emphasis was placed upon the extremely small particle size of these products; the average particle size is in the order of 5 microns or 1/5000 of an inch.

The aluminum sulphate plant was the first of its kind in Canada, although there is now another Canadian plant producing aluminum sulphate. Mr. Barker described the method of producing it from sulphuric acid and alumina hydrate.

The sulphuric acid plant at Arvida is a Monsanto contact plant. The operation of it was described and the theoretical considerations involved were touched upon.

The address attracted a large number of listeners and was enjoyed by all. S. M. Patterson thanked Mr. Barker.

Sandwiches and coffee were served at the close of the meeting.

SARNIA BRANCH

F. F. Walsh, M.E.I.C. - - *Secretary-Treasurer*
J. E. Pickering, S.E.I.C. - *Branch News Editor*

The annual Junior meeting of the Sarnia Branch of the Institute was held in the Vendome Hotel at 8:30 p.m. on May 14, 1947. The evening|s programme was organized and conducted by the Junior members with Don Schmidt acting as chairman.

Fred Walsh reported on the recent E.I.C. annual meeting held in Toronto. Frank Dyer then reported on the Town Planning Meeting held last week by the Chamber of Commerce.

The Junior and Student members were then introduced by Fred Walsh and Frank Dyer, and Jack Garton of Imperial Oil Ltd. spoke on **Small Scale Enterprises for Engineers.** He was introduced by Don McGillivray.

Mr. Garton's speech was prepared from an economic viewpoint and, not from personal experience. He defined a small scale enterprise as having a capitalization of $100,000 or less, employing less than 25 persons, and consisting of a one-man organization, a partnership, or a limited company. The speaker maintained that many small businesses are preferable from the national standpoint than a few large ones as they offer good training for management and leadership and thus help to make good citizens.

Mr. Garton believed that most engineers, especially the younger ones, desire to get into business for themselves, but they are influenced by such considerations as the security of a salaried position, the excellent working conditions and pleasant association with other engineers in a larger company, lack of finance, the constant personal attention required by a small business, and the prospect of bankruptcy.

The advantages of owning a small business were listed as freedom and independence in business, the prospect of large financial returns, independence from supervision, a broad scope of work, and the fact that the results of effort are more readily apparent.

The speaker felt that an engineer desiring to organize and run a small enterprise requires an overwhelming desire for independence in business, an ability to organize ideas and people, and a familiarity with finance and accounting. He maintained that to enter into business a man must have an idea, but if such a business is to survive lean years the idea must be a very good one. He was of the opinion that most engineers would choose either manufacturing or a consulting business.

The types of manufacturing enterprises most likely to succeed were listed in the following order: production of established consumer goods, production of raw materials for the manufacturers, production of sub-assemblies or component parts for other industries, production of new products. The speaker went on to outline the business set-up required by a small manufacturing organization.

Mr. Garton then discussed entry into a consulting engineering business. This he said was usually done in one or more of 3 ways; through the university—especially professors, lecturers and sometimes students; by joining a consulting firm and eventually becoming a partner; or by entering the consulting field alone.

The speaker linked the manufacturer's agency closely with a consulting business. The latter requires a minimum of capital but a clientele is very important.

Mr. Garton concluded with the statement that the planning of a business concern in itself, even if it is not carried through to practice, is a valuable experience, and will undoubtedly broaden any engineer's viewpoint on industry and business.

Following Mr. Garton's address a round table discussion on **The Viewpoint of the Young Engineer** was led by Jim Blayney with the assistance of Graham Wanless and Alex Jeffrey. The discussion was brisk and centred around the attitude of the young engineer toward industry. In this regard the chief point seemed to be whether industry preferred fresh graduates or men with a few years experience and whether it was advisable for a young engineer to remain with one employer or to change frequently.

It might also be added that the Sarnia Branch have offered their services to the Chamber of Commerce, the Sarnia, Point Edward, and Township Councils, for the purpose of assisting in the town planning of Sarnia and District.

WINNIPEG BRANCH

R. T. Harland, M.E.I.C. - - *Secretary-Treasurer*

Electrical Section

L. A. Bateman - - - - - - - – *Secretary*
D. C. Bryden - - - - - - - – *News Editor*

Two meetings of the Electrical Section of the Winnipeg Branch of the Institute were held in May.

On May 1, O. W. Titus, chief engineer, Canada Wire and Cable Company addressed a joint meeting of the Electrical Section and the Winnipeg Branch on **Trends in Electrical Wire Insulations and High Voltage Power Cables.** Mr. Titus discussed some of the new developments in wire insulations and also the various designs of high voltage power cables. His talk was supplemented by lantern slides and numerous samples and the members found it extremely informative.

The Electrical Section held a dinner and dance at the Marlborough Hotel on May 6, this being the final meeting for the season. The speaker, W. F. Sutherland, merchandising manager of the Winnipeg Hydro Electrical System, gave an outline of design features of modern electrical appliances and also showed the Canadian Westinghouse Company film "The Dawn of Better Living", illustrating the conveniences and comforts derived from the use of electrical appliances in the home.

Head table guests at Winnipeg, left to right: H. L. Briggs, Mrs. W. F. Sutherland, T. E. Storey, Mrs. M. D. Young, W. F. Sutherland, Mrs. E. P. Fetherstonhaugh, Chairman D. A. McCuaig (hidden), Mrs. H. L. Briggs, Dean Fetherstonhaugh, Mrs. D. A. McCuaig, M. D. Young, Mrs. T. E. Storey.

VICTORIA BRANCH

S. H. Frame, M.E.I.C. - - *Secretary-Treasurer*
J. A. Merchant, Jr.E.I.C. - *Branch News Editor*

On Thursday evening May 15, the Victoria Branch conducted a **Symposium on Soil Machanics.** Major R. C. Farrow, chairman of the branch, J. S. Kendrick, of Victoria, and P. M. Cook, of Vancouver were the principal speakers. The meeting was the fifth of the year, with an attendance of seventy interested listeners. J. H. Blake was the acting chairman.

In Major Farrow's remarks he pointed out the importance which the science of soil mechanics has assumed, especially in the war years. He showed that, in British Columbia, this science was becoming increasingly important because of the large number of small earth dams, either existing or under construction which must be inspected and approved. Major

Farrow then introduced the two speakers who were to follow, commenting on the interest and energy they were putting into their work.

Mr. Kendriek, inspecting engineer on dam construction for the Water Rights Branch, pointed out the complexities of soil mechanics as compared with other branches of mechanics. He showed the necessity of a detailed knowledge of soil mechanics in the design of foundations and earth structures. He also gave an outline of the criteria which govern the design of earth dams.

Mr. Cook of the British Columbia Scientific Research Council described the tests, apparatus used and precautions necessary in obtaining proper soil samples. He dealt first with the indicator tests, and showed how these were used in determining the necessity of other tests such as for consolidation and shear. Finally Mr. Cook spoke of the importance of good sampling, and discussed the various methods of sampling.

The meeting was thrown open for questions and a lively discussion followed which indicated the general interest in the subject.

George P. Melrose, deputy minister of lands and forests of the British Columbia Government, was asked by the chairman for a few remarks. Mr. Melrose emphasized the remark made by Major Farrow as to the importance of rigid inspection of the nature of the soil under heavy structures, as well as of those structures consisting wholly of earth, such as earth dams. At the close of his remarks he tendered the thanks of those present to the speakers.

Library Notes

Book notes, Additions to the Library of The Engineering Institute, Reviews of New Books and Publications

BOOK REVIEW

PICAO—SPECIAL RADIO TECHNICAL DIVISION (COT) FINAL REPORT—FIRST SESSION

Provisional International Civil Aviation Organization, Montreal, January 1947. 84 pp., illus., paper, 75 cents.

Reviewed by J. J. Green, M.E.I.C.*

This publication represents the distilled essence of fourteen meetings of the Special Radio Technical Division of PICAO in its first session, held during a brief one-month period late in 1946. The objective of these meetings was the attainment of mutual agreement among the delegates from Member States on the standardization of radio aids for air navigation and traffic control. The Session was preceded by demonstrations of some of the latest British, American and Australian radio and radar equipment.

Despite the short period of time devoted to the Session, the complexity of the problems faced and the obvious lack of suitable radio equipment fulfilling all the presently known functional requirements laid down for the ideal systems of radio aids, the report shows that substantial agreement was reached on the type of equipment to be recommended for present adoption in four of the six important categories considered. The central portion of this report is accordingly devoted to detailed recommendations on the four systems on which agreement was reached. It must be remembered that this document has yet to be adopted by the Council before its contents are approved and become recommended standards.

It is not necessary to be an expert in radio in order to read and appreciate most of this report. For those interested in the problems of all-weather air transportation the document will be found to be stimulating. The layman who wishes to gain an overall picture of the several ways in which radio is to increase the safety and regularity of flying will find the report interesting, taken in conjunction with supplementary reading of a more popular nature. The greatest challenge, however, is to the radio engineer. Here, reading between the lines, are the shortcomings of existing radio systems. In precise terms the requirements to be met are clearly specified and in many cases the fields of research most likely to yield early results of value are indicated. The document should be a rich source of inspiration for research in applied radio. The report is of course primarily for the information and guidance of those Government Departments charged with the planning and provision of radio aids to air navigation and of those airline personnel directly involved.

The report is divided into ten sections. Section I deals with the functional requirements of each category of radio aid. Precise, lucid statements are first made of the characteristics of the ideal radio aid in so far as these can, at the present time, be formulated. These are followed by a statement of the immediate objectives, which embrace only those requirements of the ideal system that are capable of being achieved with existing equipment or with services now under development. Section I considers the following five categories of radio aids:

Radio aids to the final approach and landing of aircraft.
Short-distance radio aids to navigation.
Aids to air traffic control.
Long-distance aids to air navigation.
Radio aids to collision warning.

Section II gives in detail the general plan adopted by the Division for the evaluation of each system submitted for acceptance in the various categories. Sections IV to VII are concerned with the four categories in which agreement was reached on the equipment to be recommended, these being radio aids for the final approach and landing, short and long-distanee navigation aids and radio aids in the movement area (for assistance in the control of aerodrome surface traffic). In none of these cases did the Division consider that the equipment it recommended for immediate use was sufficiently proven to justify universal adoption as the sole radio aid. Those who have listened to the arguments advanced by the proponents of the two best-known systems for aiding in the final approach and landing will be interested in the stand taken by the Division, and in the matter of navigation aids the recommendations of the Division may well be of significance to all pilots, including the itinerant private pilot. On the question of traffic control in the movement area, the deliberations of the Division reveal that much development work will be needed before we can hope for a satisfactory system.

Section VIII is a lengthy one in which are revealed the possible future trends of radio aids to aviation in navigation, communication and radar in search and rescue. This makes very interesting reading and in places helps to dispel some of the gloom with which even the experts have at times regarded the problems of all-weather, high traffic-density flying.

Section IX is of more interest to the radio engineer than to the general reader as it deals with VHF radio-telegraph transmission. Section X contains recommendations and resolutions, dealing among other things with the stimulation of researeh and development.

The report concludes with annexes in which eertain United Kingdom and United States viewpoints regarding some of the radio aids are expressed.

*Chief Research Aeronautical Engineer, Air Transport Board, Ottawa, Canada.

ADDITIONS TO THE LIBRARY

TECHNICAL BOOKS, ETC.

Bases de la Résistance Mécanique des Métaux et Alliages:
Pierre Laurent and others. Paris, Dunod, 1947. 288 pp., illus., paper.

Bibliography of Industrial Engineering and Management Literature to January 1st, 1946; 5th edition:
Ralph M. Barnes and Norma A. Englert. Dubuque, Iowa, Wm. C. Brown, c1946. 136 pp., paper.

Electronics; What Everyone Should Know:
Calvin and Charlotte Mooers. N.Y., Bobbs-Merrill, c1947. 231 pp., illus., cloth.

Elementary Vectors for Electrical Engineers; 2nd ed.:
G. W. Stubbins. London, Pitman, 1945. 110 pp., illus., cloth.

Engineering New-Record; Index for the Years 1928 to 1943 Inclusive:
C. R. Skillman, comp. N.Y., McGraw-Hill, c1947. 414 pp., cloth.

Noteworthy Canadian Achievements in the Design and Construction of Paper Making Machinery:
Dominion Engineering Company, Montreal, (1947). 107 pp., illus., cardboard.

Practical Designs for Drilling, Milling, and Tapping Tools: 2d ed.:
C. W. Hinman. N.Y., McGraw-Hill, 1946. 416 pp., illus., cloth.

Rapport Général sur le Premier Plan de Modernisation et D'Equipement:
France, Commissariat G'n'ral du Plan . . ., November, 1946-January, 1947. 198 pp., illus., paper.

Refrigeration; Theory and Applications; 2d edition:
H. G. Venemann. Chicago, Nickerson & Collins, c1946. 336 pp., illus., cloth.

Relativity; the Special and General Theory:
Albert Einstein, translated by R. W. Lawson. N.Y., Peter Smith, c1947. 168 pp., cloth.

Rockets and Space Travel; the Future of Flight Beyond the Stratosphere:
Willy Ley. N.Y., Viking Press; Toronto, Macmillan, 1947. 374 pp., illus., cloth.

Tables of Integrals and other Mathematical Data; Rev. ed.:
Herbert Bristol Dwight. N.Y., Macmillan, 1947. 250 pp., illus., cloth.

Talking Wire; the Story of Alexander Graham Bell:
O. J. Stevenson; illustrated by Lawrence Dresser. N.Y., Julian Messner, c1947. 207 pp., illus., cloth.

Time, Knowledge and the Nebulae . . .
Martin Johnson. N.Y., Dover Publications, c1947. 189 pp., cloth.

PROCEEDINGS, TRANSACTIONS, TECHNICAL BULLETINS, ETC.

Canada. Forest Products Laboratories:
Circular: —62—Chemical Composition of Western Red Cedar Bark, K. H. Cram, J. A. Eastwood and others.

...Mimeograph: *—113—Strength Tests on Glued Laminated Beams, C. F. Morrison and others.—114—Improved Wood.—115—Effect of Exposure on Strength of Douglas Fir Cross-Arms, W. E. Wakefield.—120—Effect of High Temperatures on Casein and Cold-Setting Urea-Formaldehyde Glues; Exposure Tests on Close-Contact Joints, Earl G. Bergin.—121—Tension Normal to Glue Line Plywood Test, W. E. Wakefield.—124—Ethyl Alcohol from Wood, H. Schwartz and C. Greaves.—125—Packing for Export, R. S. Millett.*

Canada. Prairie Farm Rehabilitation Act:
Eleventh Annual Report of Activities, March 31, 1946.

Electrochemical Society. Preprints:
91-25—Electric Apparatus for Three-Phase Arc-Furnaces, N. R. Stansel and A. R. Oltrogge.—91-26—Dissolution of Gold in Cyanide Solutions, P. F. Thompson.—91-27—Barium Silicate Phosphors, Keith H. Butler.—91-28—Scaling at High Temperatures in Sulfur Dioxide, Oxygen and Nitrogen-Containing Atmospheres, J. H. Nicholson and E. J. Kwasney.—91-29—Kinetics of Oxide Film Formation on Metals and Alloys, Earl A. Gulbransen.—91-30—Aluminum Backed Phosphor Screen in Cathode Ray Tubes, Arthur Bramley.—91-31—Withdrawn.—91-32—Electron Diffraction Study of Oxide Films Formed on High Temperature Oxidation Resistant Alloys, J. W. Hickman and E. A. Gulbransen.—91-33—Some Applications of Tantalum in Electronics, L. F. Yntema and R. W. Yancey.

Ingeniors Vetenskaps Akademien. Handlingar:
(Royal Swedish Academy of Engineering Sciences. Proceedings) *Nr 192—Details of the Quartz Transformation in Silica Bricks, P. J. Holmquist.*

National Research Council of Canada. Information for the Press:
No. 8—Building Code for Smaller Municipalities.

Purdue University. Engineering Experiment Station. Research Series:
98—Solution of Transient Heat Conduction Problems by Finite Differences, G. A. Hawkins and J. T. Agnew—99—Ten Years of Highway Research, K. B. Woods.

Society for the Promotion of Engineering Education:
Proceedings, Volume 53, 1945-46.

University of Minnesota. Engineering Experiment Station. Technical Papers.
57—Progress Report of Subcommittee on Methods of Measuring Strength of Subgrade Soil; Review of Methods of Design of Flexible Pavements, Miles S. Kersten.—58—Subgrade Moisture Conditions Beneath Airport Pavements, Miles S. Kersten.—59—Low Mean Temperature Thermal Conductivity Studies, F. B. Rowley, and others.

U.S. Geological Survey:
Bulletin: *—946-F—Geology of the Cuarenta Mercury District State of Durango, Mexico.—947—Mineral Resources of Alaska; Report of Progress of Investigation in 1943 and 1944, J. C. Reed and others.*

...Professional Papers: *210-C—Reptilian Fauna of the North Horn Formation of Central Utah.—212—Monterey Formation of California and Origin of its Siliceous Rocks.*

...Water-Supply Papers: *994—Cloudburst Floods in Utah, 1850-1938.—1003—Surface Water Supply of the United States, 1944—Part 3—Ohio River Basin.—1013—op. cit.—Part 13—Snake River Basin.—1015—op. cit.—Hawaii, July, 1943 to June 1944.—1040—op. cit., 1945—Part 10—Great Basin.*

STANDARDS, SPECIFICATIONS, TENTATIVE STANDARDS, ETC.

American Institute of Electrical Engineers:
AIEE No. 32, May, 1947—Standard for Neutral Grounding Devices.

British Standards Institution. British Standards:
BS 325—1947—Black Cup and Countersunk Bolts, Nuts and Washers.—BS 1350-57—1947—Wrought Magnesium Alloys.—BS 1367—1947—Code of Procedure in Inspection of Copper-Base Alloy Sand Castings.—BS 3024—1947—Ships' Side Scuttles.

PAMPHLETS, ETC.

Bearing Metals and Bearings; a List of Articles Published Between 1942 and 1946:
R. Ruedy. Ottawa, National Research Council of Canada, 1946. (N.R.C. No. 1324).

Plastics in Industry:
A. E. Williams. Manchester, Emmott, 1947. (Mechanical World Monographs, (35)).

Traffic Survey of Shreveport Metropolitan Area:
Louisiana Dept. of Highways in cooperation with the Public Roads Administration, Federal Works Agency and the City of Shreveport, 1944-1945.

Social Security; Selected List of References on Unemployment, Old Age and Survivors', and Health Insurance; rev. ed.
Matthew A. Kelly and H. C. Benjamin. Princeton University. Industrial Relations Section, 1947. (Bibliographical Series No. 78).

BOOK NOTES

The Institute does not assume responsibility for any statements made; they are taken from the preface or the text of the books.

Prepared by the Library of The Engineering Institute of Canada

BIBLIOGRAPHY OF SOIL SCIENCE, FERTILIZERS AND GENERAL AGRONOMY, 1940-1944:
Imperial Bureau of Soil Science, Harpender, England, 1946. 567 pp., cloth, 30/–.

This, the 4th volume of the Bibliography of Soil Science, covers one year more than each of the three earlier volumes. Access to literature published elsewhere than the British Empire and the United States during the war years, was largely a matter of chance, nevertheless it is believed that most of the more important of the reduced number of papers published from Western Europe while it was under German domination are included. The Bibliography is classified and decimal notation used. Subject and author indexes are included. The volume serves as a cumulative index to Soils & Fertilizers, Vols. IV to VII.

BRITISH STANDARDS INSTITUTION. 1946 YEARBOOK:
London, B.S.I., 1946 2/–.

A subject index and a synopsis of each of the 1,300 British Standards now current, and information regarding the Institution, its Council and Industry Committes are given in the Yearbook.

BRITISH STANDARD SPECIFICATIONS FOR DRAWING PAPERS (TRACING, DETAIL AND CARTRIDGE). B.S. 1323-1946:
London, British Standards Institution, 1946. 2/–.

Four British standards, in the drawing office equipment and material series, have been issued in a single pamphlet, the titles of the specifications being: Prepared Tracing Paper, Natural Tracing Paper, Detail Drawing Paper, and Cartridge Drawing Paper.

BRITISH STANDARD SPECIFICATION FOR HUMIDITY OF THE AIR (DEFINITIONS, FORMULAE AND CONSTANTS). B.S. 1339-1946:
London, British Standards Institution, 1946. 2/–.

The terms and definitions recommended for hydrometric measurement are based on majority usage. Simple formulae are given for determining the vapour pressure, and indirectly the moisture content, absolute humidity, density, humid volume, and total heat of moist air, from wet and dry-bulb temperature readings. Each formula is accompanied by a table of constants for various systems of units.

INVOLUTE SPLINES, SIDE BEARING. (ASA-B5.15-1946)

New York, American Standards Association, 1946. $1.00.

One of a series of standards for small tool and machine tool elements, B5.15-1946 is a revision of the 1939 Standard on Involute Splines. The new edition is more flexible in application with respect to both design and manufacturing considerations than was the 1939 edition. The phases covered include size, ranges and pitches, fits, pressure angle, spline selections for anti-friction bearings, measurement with pins, tongue capacities, tolerances for external and internal splines, involute spline hobs, and tolls for internal teeth.

LETTER SYMBOLS FOR CHEMICAL ENGINEERING. (ASA—Z10.12—1946):

New York, American Standards Association, 1946. 50 cents.

This new standard covers 163 Letter Symbols and is designed to give chemists and chemical engineers a uniform system of "shorthand" for use in their mathematical calculations. The letter symbol is defined as a "single character, with subscript or superscript, if required, used to designate a physical magnitude in mathematical equations and expressions". The symbols included in this standard therefore are not to be confused with those designating chemical elements or groups.

Sections deal with acceleration, diffusity, entropy, molecular weight, surface tension, thermal conductivity, heat transmission, flow of fluids, evaporation, humidification, gas absorption and extraction, distillation, drying, sedimentation, crystallization, and others.

NATIONAL FIRE CODES, VOLUME V-NATIONAL ELECTRICAL CODE (ASA C 1—1946); 1947:

National Fire Protection Association, Boston, c1946, 408 pp., illus., 6 x 9 in. cloth, $2.00.

This edition is a collection of rules governing the installation, and to some extent, the use of electrical equipment with the view of reducing the hazard from electrical fires and accidents. It specifies the exact manner in which electrical materials, devices, fittings and appliances shall be originally installed and later maintained.

LES PORTS MARITIMES:

A. de Rouville. Paris, Dunod, 1946. 188 pp., illus., 13 x 21, paper, 250 fr.

This book was written for technicians employed in the construction of maritime harbours and called upon to study the problems caused by their wartime destruction. It begins with a discussion of the nature of sea water, the forces which agitate it (the wind, moon, etc.) and which manifest themselves in the form of swells, tides, and currents. Floating docks and other methods of ship refitting, construction machinery, and navigation affected by globular currents are considered in detail. A study of the large rivers and canals follows and the book concludes with a discussion on the clearing of harbours.

SYMPOSIUM ON ADHESIVES:

Sponsored by Committee D-14 on Adhesives, American Society for Testing Materials. Philadelphia, A.S.T.M., c1946. 62 pp., illus., paper, $1.00.

This, the first symposium by the new committee D-14, comprises seven papers:—Types and uses of Adhesives; General Theory of Adhesion; Strength Properties (Subcommittee I); Analytical Procedures Used on Adhesives (Subcommittee II); Permanence Tests of Adhesive Bonds (Subcommittee III); Adhesive Working Qualities (Subcommittee IV); and Preparation and Uses of Specifications for Adhesives (Subcommittee V).

THE THEORETICAL BASIS OF ADHESION:

By W. A. Weyl, (14 pp., paper, 50 cents).

A paper presented at a meeting of A.S.T.M., Committee D-14, June 1946, is also available from the A.S.T.M.

UTILIZATION OF SEWAGE SLUDGE AS FERTILIZER:

Sub-Committee on Utilization of Sludge as Fertilizer, Langdon Pearse and A. H. Niles, co-chairmen. Champaign, Ill., Federation of Sewage Works Association, 1945. 120 pp., tables, paper, $1.25. (Manual of Practice No. 2).

This treatise constitutes an evaluation of the advantages and limitations of sewage sludge as a soil conditioner for agricultural purposes. It is practical and complete. Soil requirements; the contents of fertilizer elements in all types of sewage sludge; experimental results; methods of processing and applying sludge for soil conditioning purposes; hygienic aspects; economic factors; etc., are covered in detail. A bibliography is appended.

WAGES UNDER NATIONAL & REGIONAL COLLECTIVE BARGAINING; EXPERIENCE IN SEVEN INDUSTRIES:

Richard A. Lester and E. A. Robie. Princeton, Princeton University. Industrial Relations Section, 1946. 103 pp., paper, $1.50. (Research Report Series No. 73)

Experience with uniform wage scales under national or regional collective bargaining in seven manufacturing industries is examined in this report. The industries surveyed were the Pressed and Blown Glassware Industry, the Pottery Industry, the Stove Industry, the Full-Fashioned Hosiery Industry, the Silk and Rayon Dyeing and Furnishing Industry, the Flat Glass Industry, and the West Coast Pulp & Paper Industry. Criteria stressed in the selecting of the specific industries surveyed were (1) a sufficiently long period of experience with standard industry rates under national or regional bargaining, and (2) wide variation in the economic circumstances and experience of the selected industries.

For purposes of comparison, a brief resume of wage experience and the extent of wage uniformity, under national bargaining in Sweden and in England is given in Appendix A.

The following notes on new books appear here through the courtesy of the Engineering Societies Library of New York, and may be consulted at the Institute Library.

Bibliography of INDUSTRIAL ENGINEERING and MANAGEMENT LITERATURE to January 1, 1946.

R. M. Barnes and N. A. Englert. 5th ed. Wm. C. Brown Co., 973 Main St., Dubuque, Iowa. 136 pp., 11 x 8½ in., paper, $3.00.

Part I of the fifth edition of this bibliography, revised to January 1, 1946, contains some 1,200 titles of books and bulletins in the general field of management published in the last 30 years. The second part lists over 3,000 articles and papers on motion and time study and related subjects. Both lists are alphabetically arranged by author. There are also a detailed classification of the articles and papers by subjects and an alphabetical list of the 145 magazines and journals from which articles were taken.

CONSTRUCTION DES AVIONS:

G. du Merle, prefaceby P. Dumanois, 2 ed. Dunod, Paris, 1947. 855 pp., illus., diagrs., charts, tables, 11 x 7½ in., paper, 2,350 frs.

Intended mainly for the aeronautical engineer, this comprehensive treatise contains a wealth of useful information for any one interested in aviation. Both the external and internal structure of the conventional plane are described, aerodynamic characteristics are discussed, and the equipment for suspension, fuel supply, lubrication, cooling, and controls of various kinds are dealt with in detail. Considerable space is devoted to important manufacturing procedures. There are chapters on safety and comfort in flight, special types of planes (helicopters, jet planes, gliders, etc.), civil and military operation. Photographs, three-projection views, and tables of characteristics are included for all important French and foreign airplanes. There are a glossary and two detailed indexes, by subject and by type of plane.

ELEMENTARY VECTORS FOR ELECTRICAL ENGINEERS:

G. W. Stubbings. 2 ed. Sir Isaac Pitman, London, Toronto, 1945. 110 pp., diagrs., tables, 7½ x 5 in., cloth, $2.00 (in Canada).

This practical little volume emphasizes fundamentals and devotes the first two chapters to explaining the representation of a-c quantities by graphical vectors. Chapter III contains a detailed elementary treatment of the graphical solution of three phase problems, and the following two chapters deal with the concept and applications of vector algebra. A short, final chapter discusses the geometrical meaning of hyperbolic functions.

GERMAN RESEARCH IN WORLD WAR II:

L. E. Simon. John Wiley & Sons, New York; Chapman & Hall London, Ltd., 1947. 218 pp., illus., diagrs., tables, 9¼ x 6 in. cloth, $4.00.

The author, one of a group of scientists commissioned to visit Germany immediately after the surrender, presents an analysis of the organizations engaged in the German war research. In connection with this he surveys their important results in the field of interior, exterior and terminal ballistics, fire control, instruments and measurement techniques, and aerodynamics. Rockets sonic devices, and other unusual types of weapons are described. As an appendix to the critical discussion of German research methods, the author concludes with a chapter of comments and criticisms applicable to research in general.

(Continued on page 364)

PRELIMINARY NOTICE

of Applications for Admission and for Transfer

June 25th, 1947

The By-laws provide that the Council of the Institute shall pprove, classify and elect candidates to membership and transfer om one grade of membership to a higher.

It is also provided that there shall be issued to all corporate iembers a list of the new applicants for admission and for 'ansfer, containing a concise statement of the record of each pplicant and the names of his references.

In order that the Council may determine justly the eligibility of ich candidate, every member is asked to read carefully the list ibmitted herewith and to report promptly to the Secretary any icts which may affect the classification and selection of any of ie candidates. In cases where the professional career of an pplicant is known to any member, such member is specially ivited to make a definite recommendation as to the proper assification of the candidate.*

If to your knowledge facts exist which are derogatory to the ersonal reputation of any applicant, they should be promptly ommunicated.

Communications relating to applicants are considered y the Council as strictly confidential.

The Council will consider the applications herein described at ie August meeting.

L. Austin Wright, General Secretary

*The professional requirements are as follows:—

A **Member** shall have been engaged in some branch of engineering for at ast six years, which period may include apprenticeship or pupilage in a qualified igineer's office or a term of instruction in a school of engineering recognized y the council. In every case a candidate for election shall have held a position professionl responsibility for at least two years. The occupancy of a chair professor, assistant professor, associate professor or lecturer in a faculty of pplied science or engineering, shall be considered as professional responsibility. Every candidate who has not graduated from a school of engineering recognized by the council shall be required to pass an examination as prescribed by ouncil, on the theory and practice of engineering, with special reference to ie branch of engineering in which he has been engaged.

A **Junior** shall have been engaged in some branch of engineering for at least our years. This period may be reduced to one year, if the candidate for election as graduated from a school of engineering recognized by the council, in which ase he shall not remain in the class of Junior beyond the end of the eighth ear after graduation.

Every candidate who has not passed the examinations of the third year in a chool of engineering recognized by council shall be required to pass an examination in engineering science as prescribed by council. He shall not remain in the lass of Junior beyond age thirty.

A Junior may be transferred to Member without payment of transfer fee roviding he makes application before the end of the seventh year after graduation or, if a non-graduate, before attaining age twenty-nine, and his application approved by council.

Council may extend the above limits if in its opinion special circumstances 'arrant such extension.

A **Student** shall be at least seventeen years of age, and shall present a certicate of having passed an examination equivalent to the final examination of a igh school, or the matriculation of an arts or science course in a school of ngineering recognized by the council or shall be required to write examinations s prescribed by the council.

He shall be:

a. pursuing a course of instruction in a school of engineering recognized by the ouncil, in which case he shall be transferred to Junior automatically without ayment of transfer fee in the second January after graduation, or

b. receiving a practical training in the profession in which case he shall be ransferred to Junior without payment of transfer fee providing he makes pplication before attaining age twenty-five and his application is approved by ouncil.

He shall not remain in the class of Student after he has attained the age of wenty-five, unless in the opinion of council special circumstances warrant the xtension of this age limit.

An **Affiliate** shall be one who is not an engineer by profession but whose ursuits, scientific attainments or practial experience qualify him to coperate with engineers in the advancement of professional knowledge.

The fact that candidates give the names of certain members as reference does not necessarily mean that their applications are endorsed by such members.

FOR ADMISSION

BANNERMAN—EUGENE CAMPBELL, of Bathurst, N.B. Born at Sydney, N.S., Jan. 31, 1906. B.Sc., (Mech.), Nova Scotia Tech., 1930; 1923-29, mills, foundry, mach. shop, drawing off., iron & steel divn., Dominion Steel Co., Sydney; and with Sydney & Louisburg Rly.; 1930-33, engrg. sales, Wm. Stairs Son & Morrow, Halifax; 1933-41, asst. i/c mtce. and constrn., Dominion Iron & Steel Divn., DOSCO, Sydney; 1941-45, R.C.E.M.E.; 1945-46, engr., Iron & Steel Divn., DOSCO, Sydney, N.S.; at present, asst. chief engr., Bathurst Power & Paper Co., Bathurst, N.B.

References: W. S. Wilson, J. A. MacLoed, M. W. Booth, S. G. Naish, W. C. Baggs.

DEMARQUE—GEOFFROY MARIE, of Montreal, Que. Born at Mauze, (Deux-Sevres), France, Feb. 15, 1906. Educ.: Ingenieur des constructions civiles, Ecole Nationale des Ponts et Chaussees, Paris, 1929; 1930-33, first, member tech. bureau, after, engr. i/c cost and acctg. for genl. contractor in Casablanca and Fes, Morocco, Societe des Grands Travaux de Marseille, 25 rue de Courcelles, Paris; 1933-36, res. engr. & mgr. in Oran (Algeria) for Societe de Commentry—Oissel, contrn. of an apt. house, plant and the terminal maritime station; 1937-39, dir. & genl. mgr., Enterprise Descombes et Devallois, LePecq and Paris, genl. contractors; 1944-45, tech. director Bureau d'etudes des Maisons Schneller, Paris, prefabricated houses; 1946-47, member of tech. organization of Societe Technique pour l'utilisation de la Precontrainte, Paris (precompressed concrete) Freyssinet processes; at present, part of organization of Mount Enterprises Ltd., Montreal, Que.

References: A. F. Vaison, J. F. Brett, M. Doye, P. P. LeCointe, I. Brouillet, C. M. Morssen.

GAIN—JOHN CHARLES CLARE, 69 MacKay Ave., Toronto, Ont. Born at Toronto, Ont., March 12, 1924. Educ.: B.A.Sc., (Chem. Engrg.), Toronto, 1946; 1946-47, chemist, control lab., general analytical work, coal analysis, etc.

References: R. R. McLaughlin, E. A. Allcut, C. R. Young, R. F. Legget, W. S. Wilson, W. J. T. Wright.

GREENHOW—DONALD MARRIOTT, of Kingston, Ont. Born at Boldon, Durham, Eng., July 28, 1920. Educ.: B.Sc., (pure science), King's College, Univ. of Durham, England, 1940; 1940, asst. chemist, B.S.A. Ltd., Birmingham, England; 1940-46, Pilot, Royal Air Force; 1946 to date, foreman, sizing area, Nylon divn., Canadian Industries Limited, Kingston, Ont.

References: R. D. Bennett, E. Thom, G. T. L. Andrews, J. R. Carter, F. Hubbard.

KENNY—BRIAN MANSELL, of Brantford. Ont. Born at London, England, June 27, 1906. Educ.: 1925-29, I.C.S. (elect. engrg.); R.P.E., Ontario, (admitted on credentials without exam.); 1925-27, asst. to supt. ,Scarboro Hydro-Electric System, Birch Cliff, Toronto; 1928, asst. to supt., H.E.P.C. of Ontario; with Canadian General Electric., as follows: 1930-31, asst to supply mgr., Ottawa, 1933-34, asst. engr. air cond. divn., 1935-41, app. engr., Ottawa, 1942-43, industrial engr., Peterboro; Waterous Ltd., Brantford, Ont., as follows: 1943-47 asst. genl. mgr., and at present ,asst. genl. sales mgr.

References: R. M. Pendergast, H. R. Sills, S. Hairsine, R. E. Hayes, J. L. Balleny, R. T. Bell.

LEWICKI—WLADIMIR PETER, of Three Rivers, Que. Born at Opolsko, Poland (now Russia), June 23, 1908. Educ.: Engineer, Akademia Gornicza, (Cracov Univ.), Cracov, Poland, 1934, (Member ,Assn. Polish Engrs. in Canada. Educ.:qualifications guaranteed by Assn. which states this degree is equivalent to Master degree in engrg. here); 1934-35, jr. engr., tool machine plant, Poremba, Poland; with Huta Bankowa, Poland, as follows: 1935-37, rolling mill engr., steel plant, 1937-38, rolling mills supt., steel plant; 1938-39, asst. chief, engr., steel plant, Huta Trzynic, Poland; 1940-41, head roller, steel plant, Trignac, France; 1942, consultg. engr., Portuguese Government; 1942-43, foreman, and afterwards, supt., rolling mill, Sorel Industries Ltd.; with Dominion Foils Limited, as follows, asst. plant engr., Lachine, 1945 to date, chief engr., Cap de la Madeleine, Que.

References: E. Gohier, N. P. Taylor, J. Pawlikowski, D. Goddard, M. B. Szymanski.

MORRISON—COLIN EDWIN, of Windsor, Ont. Born at Kelowna, B.C., Dec. 8, 1914. Educ.: B.Sc., (Mech. Engrg.), Tri-State College, 1942, (not accredited E.C.P.D.); with Chrysler Corp. of Canada, Windsor, as follows: 1942-43, jr. automotive engr., 1943-44, asst. project engr., (truck chassis), 1944, project engr., responsible for design and engrg. follow-up as related to Canadian prod., 1944-45, power plant engr., responsible for all design and engrg. follow-up relative to mfg. in Canada of pass. car, truck, industrial and marine engines, assemblies, responsible for vehicle performance; acted as intermediary on problems between Corporation's engrg. dept. and Army Engrg. Design Branch, Ottawa, responsibility included interpretation of Canadian Army specifications and changes as related to various components of Chrysler vehicles; i/c important wartime projects incl. ¾ton 4 x 4 water wader and special Invasion barge marine engine; graduate student Chrysler Institute of Engrg., Detroit, Mich., and acting in an advisory capacity on special assignments for the Canadian Chrysler Corporation of Canada, Windsor, Ont.

References: G. W. Lusby, R. S. Segsworth, I. Widdifield, N. O. Paquette.

RICH—CLIFFORD EARL, of St. Lambert, Que. Born at Sycamore, Ill., Feb. 5, 1903. Educ.: B.Sc., 1927; M.Sc., (Chemistry), 1937, Saskatchewan; 1924-25, lead and copper refineries, Trail, B.C.; 1926-27, firebrick plant, Claybank, Sask.; charge of control labs., mill revision, flowsheet work, Robin Hood Milling; with Robert A. Rankin & Co., for Ogilvie Flour Mills Co., Ltd., as follows: 1935, Winnipeg, lab. research, flour mill revamping; 1941-42, Montreal. supt. of prod.; 1941-42, revision of Edmonton mill, flows; 1942-47, director of research & supt. of prod., tech. associate with R. A. Rankin & Co. for flowing and plan checking of new Montreal projects.

References: R. A. Rankin, J. B. Stirling, H. Schmelzer, C. B. McRitchie, S. M. Sproule.

ROCHESTER—STANLEY HERBERT, of Arvida, Que. Born at Swindon, England, Nov. 26, 1918. Educ.: 1935-40, Tech. College, Swindon, Eng.: Graduate, Institution E.E., London, (completed whole of the Associate Membership exams., Sections A, B, & C); 1935-40, premium apprent., turning and loco. erecting, incl. testing house and design office, Great Western Railway works, England; 1940-45, Commissioned Engr. Officer, R.A.F., with rank of Squadron Leader, command of aircraft repair and mtce., Station Workshops and all tech. personnel; 1945-46, loco. designer, dftsman., chief mech. engr.'s dept., Great Western Railway, Swindon, England; at present ,mech. mtce. engr., Aluminum Co. of Canada, Ltd., Arvida, Que.

References: W. Fraser, J. T. Nicholls, J. L. Connolly, J. W. Ward, F. T. Boutilier, B. E. Bauman.

SHARPE—ALAN LLOYD, of Montreal Que. Born at Orillia, Ont., May 10, 1921. Educ.: B.Sc., (Mech. Engrg.), Queen's, 1944; 1942, (summer) student engr., machinist, Lamaque Gold Mines, Bourlamaque, Que.; 1943, (summer), student engr., machinist, Otaco Ltd., Orillia, Ont.; 1944-46, Engr. Officer, R.C.N.V.R.; 1946 to date, jr. engr., diesel divn., Dominion Engineering Ltd., Lachine, Que.

References: B. J. McColl, S. Phillips, E. S. Ellis, D. Low, D. M. Jemmett.

(Continued on page 364)

Employment Service

The service is operated for the benefit of members of The Engineering Institute of Canada, and for industrial and other organizations employing technically trained men—without charge to either party. It would therefore be particularly appreciated if employers would make the fullest possible use of these facilities to make known their existing or estimated requirements. Notices appearing in the Situations Wanted column will be discontinued after three insertions, and will be re-inserted upon request after a lapse of one month. Personal interviews by appointment.

Situations Vacant

CHEMICAL

CHEMICAL METALLURGIST with background in extraction metallurgy and ore dressing (knowledge of minerogy desirable) and experience in use of petrographic microscope. Maximum Salary $4,000. Apply to File No. 3865-V.

CIVIL

CIVIL ENGINEERS, recent graduates up, required by an industrial organization for design of structural steel and reinforced concrete. Salary open. Apply to File No. 3864-V.

CIVIL ENGINEER required by Eastern Canadian City to supervise construction and maintenance of streets in capacity of City Engineer. Salary open. Apply to File No. 3869-V.

CIVIL ENGINEER, required in Montreal for general construction, surveys etc., Salary $200. Apply to File No. 3872-V.

CIVIL ENGINEER, recent graduate, must be bilingual, required for public utility in Quebec City. Salary open. Apply to File No. 3878-V.

CIVIL ENGINEER required as Manager for City of Ste. Therese, Que., Salary open. Apply to File No. 3881-V.

CIVIL ENGINEERS required as draughtsman in bridge department of large transport company. Preferably with experience in steel ,concrete and timber construction. Location Montreal. Salary $200-300. Apply to File No. 3884-V.

ELECTRICAL

INSTRUCTOR IN ELECTRICAL ENGINEERING required for supervision of laboratory classes in power laboratory also few lectures per week, in direct current theory for Canadian University. Salary open. Apply to File No. 3600-V (G).

ELECTR CAL ENGINEER, required by an insurance company, preferably with a few years practical experience, for the inspection of boilers, steam plant and allied equipment in Montreal area. Salary open. Apply to File No. 3754-V.

DESIGNING ELECTRICAL DRAUGHTSMAN, preferably with experience on station design and layout required in Montreal, by a pulp and paper mill. Salary open. Apply to File No. 3873-V.

ELECTRICAL ENGINEER under 30, required as sales engineer of switchgear, electrical and power-house equipment, by a manufacturer in Montreal. Considerable travelling. Salary $4,000. plus expenses. Apply to File No. 3885-V.

MECHANICAL

MECHANICAL ENGINEER, with knowledge of physical metallurgy heat treatment., ability in stress analysis and design. Maximum salary $4,000. Apply to File No. 3865-V.

MECHANICAL ENGINEER, recent graduate, required by a Montreal wallpaper manufacturer to be trained as mechanical superintendent. Salary $200. Apply to File No. 3876-V.

MISCELLANEOUS

STRUCTURAL ENGINEER, required by an industrial organization for general construction duties. Salary open. Apply to File No. 3864-V.

SALES ENGINEER, preferably with mining or mechanical background, practical experience in heavy machinery industry, shovels, cranes, etc., required by an Asbestos company in Montreal. Salary $275-$325. Apply to File No. 3870-V.

RECENT GRADUATE required by a Montreal firm handling pumps, valves, automatic controls, etc., for training leading to sales. Salary $175. Apply to File No. 3871-V.

CIVIL OR MINING ENGINEER, with executive ability, required by a construction firm in Quebec to supervise highway construction. Must be bilingual. Permanent position. Salary $300-500. Apply to File No. 3877-V.

MECHANICAL OR CHEMICAL ENGINEER, recent graduate, required by a firm in Montreal. Ability to do simple drawings, such as layout of piping and instruments. Some experience in oil refinery or chemical plant or pulp and paper would be useful. Position to eventually lead to sales. Salary $200. Apply to File No. 3879-V.

GRADUATE ENGINEERS, required for all phases of research design, operation and development by an industrial organization in Montreal. Salaries open. Apply to File No. 3882-V.

The following advertisements are reprinted from last month's Journal, having not yet been filled.

CHEMICAL

CHEMICAL ENGINEER OR CHEMIST, preferably with Ph.D., required by a pulp and paper company with plants in Eastern Canada, for research work. Salary open. Apply to File No. 3549-V.

CHEMICAL ENGINEER required by a pulp and paper company with plants in Eastern Canada, for mill control and pilot plant work. Salary open. Apply to File No. 3549-V.

CHEMICAL ENGINEER to be assigned to mill process problems for the technical department of a pulp and paper firm in the St. Maurice Valley. Salary $250. up. Apply to File No. 3573-V.

CHEMICAL ENGINEER required as assistant professor of chemical engineering in a Canadian university to start autumn 1947. Salary open. Apply to File No. 3600-V (D)

CHEMICAL OR METALLURGICAL ENGINEERS, from recent graduates up, required by a Quebec firm engaged in metal production for employment as production and development engineers. Salaries open. Apply to File No. 3693-V.

CHEMICAL ENGINEER required for the control department of a paper mill in Shawinigan Falls. Salary from $250-$350. Apply to File No. 3765-V.

CHEMICAL ENGINEER OR CHEMIST interested in textile dyeing, required by an industrial firm in South Western Quebec. Salary open. Apply to File No. 3798-V

CHEMICAL ENGINEER, required by a chemical firm in Shawinigan Falls, Quebec, for development work on plastics. Salary open. Apply to File No. 3812-V.

CIVIL

CIVIL ENGINEER to take charge of work in a drainage district in Quebec. Must be bilingual. May be recent graduate. Salary from $200. Apply to File No. 3479-V.

CIVIL ENGINEER for design work in an industrial plant in the Montreal area with experience in building construction, probably permanent position salary from $200 up according to experience. Apply File No. 3504-V.

CIVIL ENGINEERS with experience in detailing and designing structural steel and reinforced concrete for manufacturers are required for a steel fabricating company in Manitoba. Salary open. Apply File No. 3519-V.

CIVIL ENGINEERS, recent graduate up, required by a pulp and paper company with plants in Eastern Canada. Salary open. Apply to File No. 3549-V

CIVIL ENGINEER, age 35-40, with extensive experience in detailing and checking structural steel in buildings and bridges, required by a steel fabricating company in Southern Ontario. Salary open. Apply to File No. 3570-V.

GRADUATE CIVIL ENGINEER, required by a public utility in the Montreal area with three or four years' experience in design of reinforced concrete and structural steel. Salary $250-$300. Apply to File No. 3766-V.

GRADUATE CIVIL ENGINEER required by an industrial corporation in Montreal for design work in draughting room. Must be familiar with structural steel and concrete design. Position offers good opportunity and permanency to right man. Salary from $250 up according to experience, Apply to File No. 3785-V.

SEVERAL CIVIL ENGINEERS, with two or three years' experience in road construction required for road building work in Northern Quebec. Salary open. Apply to File No. 3804-V.

CIVIL ENGINEERS with some experience in design and field work required by a public utility in Toronto. Salary open. Apply to File No. 3813-V.

CIVIL ENGINEER, age 35-40, with considerable experience in design of structures, water supply, sewers, required by an organization in Montreal. Salary $300-$400. Apply to File No. 3820-V.

CIVIL ENGINEER required to act as superintendent and assistant to general contractor in Shawinigan Falls. Must be bilingual. Salary $300-$400. Apply to File No. 3827-V.

CIVIL ENGINEER, recent graduate up, required by a pulp and paper company in the Province of Quebec, for work centered in logging operations and will consist principally of the construction of roads, bridges, dams and camps. Preferably bilingual. Salary from $225—$275. Apply to File No. 3850-V.

CIVIL ENGINEER with building construction experience required by a manufacturer in Montreal. Salary $250 up. Apply to File No. 3858-V.

CIVIL ENGINEER required by Town of Pointe Claire, bilingual, minimum five years experience in municipal work, capable of preparing tenders, specifications and drawings, water and sewer systems. Salary open. Apply to File No. 3863-V.

ELECTRICAL

ELECTRICAL ENGINEER, age 32-36, with electrical experience around mines or smelters. English speaking with working knowledge of French, is required by a company in Shawinigan Falls, Quebec. Salary open. Apply to File No. 3415-V.

ELECTRICAL ENGINEER age 30-45 with sales training with large manufacturer of electrical equipment instruments and 5-10 years experience as sales service and sales engineer required as sales engineer in Canada for U.S. firm making special equipment for transport and industry. Salary open. Apply to File No. 3447-V.

ELECTRICAL ENGINEER, recent graduate, required for the engineering staff of a paper mill in the Lake St. John area. Salary open. Apply to File No. 3507-V.

ELECTRICAL ENGINEER with knowledge of power apparatus, preferably bilingual, required for sales work with a manufacturer in the Montreal area. Salary open. Apply to File No. 3646-V.

ELECTRICAL ENGINEER with considerable industrial experience required as a safety engineer by a public utility in the Montreal area. Bilingual preferred. Salary open. Apply to File No. 3654-V.

ELECTRICAL ENGINEER with several years experience required as a designer by an industrial organization in Montreal. Salary open. Apply to File No. 3677-V.

ELECTRICAL ENGINEER, with general knowledge of a.c. and d.c. motors switchgear, mercury rectifiers, transformers and other electrical apparatus for sales work in Eastern Canada, age 30 to 35, salary open. Apply to File No. 3695-V.

ELECTRICAL DRAUGHTSMAN with several years' experience in industrial layouts for large concern in Eastern Townships. Permanent position and attractive salary available for experienced men. Apply to File No. 3701-V

ELECTRICAL ENGINEER, age about 30, with considerable experience required by a manufacturer in the St. Maurice Valley. Salary open. Apply to File No. 3723-V.

ELECTRICAL ENGINEER, recent graduate up, required by a manufacturer in Montreal, for sales engineering. Preferably bilingual and familiar with rotating electrical equipment. Salary $200. up. Apply to File No. 3761-V.

GRADUATE ELECTRICAL ENGINEERS with 3 to 10 years experience in design, operation, layout of substations, switching stations, and electrical machinery, together with engineering studies, including draughting for a large hydro electric power house in Quebec. Salary $225 up. Apply to File No. 3787-V.

ELECTRICAL ENGINEER required for power sales by an electrical utility in Province of Quebec. Preferably experienced. Bilingual. Salary open. Apply to File No. 3802-V.

ELECTRICAL ENGINEER with experience in layout and design of generating and transformer stations, required by a public utility in Toronto. Salary open. Apply to File No. 3813-V.

JUNIOR ELECTRICAL ENGINEER required by a Montreal firm for inspection of electrical equipment of all kinds, in Toronto area. Salary $225. Apply to File No. 3816-V.

ELECTRICAL DESIGNING DRAUGHTSMAN with broad practical experience and theoretical knowledge required for a firm in Quebec. Salary from $225. Apply to File No. 3818-V.

ELECTRICAL ENGINEER, recent graduate up, preferably with experience in audio circuits design and maintenance also practical knowledge of fractional horsepower motors and wiring layouts, required to eventually take charge of sound maintenance for motion picture studio in Ontario. Salary open. Apply to File No. 3826-V.

MECHANICAL

MECHANICAL ENGINEER, is required for draughting and detail work with a company in central Ontario. Good prospects for advancement. Single man preferred. Salary open. Apply to File No. 3393-V.

MECHANICAL ENGINEERS, preferably with design experience, are required for armament research and development in the Quebec area, in a government establishment. Salary from $190. Apply to File No. 3401-V.

MECHANICAL ENGINEER with experience in pulp and paper or mining work required by a pulp and paper company with plants in Eastern Canada. Salary open. Apply to File No. 3549-V.

JUNIOR MECHANICAL ENGINEERS, required by a Montreal manufacturer of machines and equipment for mechanical type of work such as machine design, etc. Salary $175 up. Apply to File No. 3664-V.

MECHANICAL ENGINEER with experience in the fabrication of Farm Implements, required by a Quebec firm. Bilingual man preferred. Salary according to experience. Apply to File No. 3666-V.

MECHANICAL ENGINEER with design experience in the pulp and paper industry required by a firm in the St. Maurice Valley. Salary $350. Apply to File No. 3673-V.

JUNIOR MECHANICAL ENGINEER with knowledge of precision machine shop practice and aptitude for research work in metals and plastics required for an organization in Toronto for the production of artificial limbs. Must be veteran. Salary from $225. Apply to File No. 3675-V.

MECHANICAL ENGINEER with industrial or construction experience, required by a firm of consulting engineers to inspect machinery deliveries in the Cornwall area. Salary open. Apply to File No. 3691-V.

YOUNG MECHANICAL ENGINEERS, with practical experience either in automotive or general manufacturing industries, together with ability to operate engineering office systems, required by an industrial organization in Ontario. Salary open. Apply to File No. 3732-V.

MECHANICAL ENGINEERS, with at least five years' experience in the Pulp and Paper industry required by an Ontario Paper Company. Salary open. Apply to File No. 3733-V.

GRADUATE MECHANICAL ENGINEER, experienced in boiler operation, required as assistant superintendent on maintenance of railroad and tramways rolling stock, in the Quebec area. Salary $200. per month. Apply to File No. 3772-V.

MECHANICAL ENGINEER with 5 or more years experience in heating, ventilating and air-conditioning, required by a consulting engineer in Montreal. Salary open. Apply to File No. 3773-V.

MECHANICAL ENGINEER, with paper mill or mining experience required for design and layout by a paper mill in Northern Quebec. Salary $375-400. Apply to File No. 3778-V.

MECHANICAL ENGINEER with considerable experience willing to act as assistant to Mechanical Superintendent of a textile manufacturing concern near Montreal. Salary open. Apply to File No. 3784.-V

MECHANICAL ENGINEER, recent graduate up, required by a Pulp and Paper Company in the Province of Quebec for work entirely centred in logging operations. Salary open. Apply to File No. 3789-V.

MECHANICAL ENGINEERS required by a Pulp and Paper mill at Powell River, B.C. Preferably with experience in plant design in the pulp and paper industry. Salary according to qualifications. Apply to File No. 3796-V.

MECHANICAL DRAUGHTSMAN, with several years experience in machine design, required by an industrial organization in Montreal. Salary $250 up. Apply to File No. 3807-V.

MECHANICAL ENGINEER with at least 10 years experience in design and installation of machinery also supervisory ability required by an industrial organization in Montreal, Salary open. Apply to File No. 3807-V.

MECHANICAL ENGINEERS, with experience in plant layout and design or ventilation problems or general mechanical design, required by a firm in Quebec. Salary from $250. Apply to File No. 3818-V.

MECHANICAL ENGINEER required as assistant to vice-president and general manager of a medium sized company in Central Ontario. Experience in paper converting would be helpful. Prospects are excellent and salary open. Apply to File No. 3819-V.

MECHANICAL ENGINEER, age 35-40, with considerable experience in design and layout of machinery and equipment, required by an organization in Montreal. Salary $300-$400. Apply to File No. 3820-V.

MECHANICAL ENGINEERS, preferably with experience in machine design, required by a steel fabricating firm in Montreal for design and layout. Salary open. Apply to File No. 3824-V.

MECHANICAL ENGINEER with considerable experience, required to supervise installation of coating machine also design necessary, tankage and piping systems, for a paper mill in Ontario. Salary around $400. Apply to File No. 3828-V.

MECHANICAL ENGINEERS, required by a pulp and paper mill in Ontario for design and layout also mechanical installations. Salary around $300. Apply to File No. 3828-V.

MECHANICAL ENGINEER, required by a manufacturer in Ontario for the plant operation staff. Salary open. Apply to File No. 3833-V.

MECHANICAL ENGINEER with six to ten years experience in maintenance and engineering work, required by alkali manufacturers in Ontario. Salary open. Apply to File No. 3833-V.

MECHANICAL ENGINEER, recent graduate up, veteran preferred must be bilingual. Required to under study Manager and eventually take charge of four plants at St. John. Salary around $200 to start. Apply to File No. 3842-V.

MECHANICAL ENGINEER, recent graduate up, required by a company in Montreal for toll design. Salary $175 up. Apply to File No. 3843-V.

MECHANICAL ENGINEER experienced in mining plant construction, operation and maintenance, required by a mining company in Northwestern Quebec, at present constructing plant for relatively large scale operation. Salary $5,000 to $6,000. Apply to File No. 3845-V.

MECHANICAL ENGINEER recent graduate, preferably with some practical experience in manufacturing, required by a Farm Equipment manufacturer in Ontario. Starting salary $225. Apply to File No. 3851-V.

MECHANICAL ENGINEER, recent graduate, required by a paper mill in Northern Quebec. Salary $250. Apply to File No. 3852-V.

MECHANICAL ENGINEER, preferably with experience in heating and ventilating problems required in Montreal for design and investigation. Salary $250 up. Apply to File No. 3858-V.

METALLURGICAL

METALLURGIST, with at least 2 years foundry experience, required by a Montreal manufacturer to take charge of foundry practice and annealing. Salary open. Apply to File No. 3853-V.

MINING

MINING ENGINEERS, with varied experience required by a firm in Quebec for general mine operation, exploitation and development work. Salary from $250. Apply to File No. 3818-V.

MISCELLANEOUS

MANAGEMENT ENGINEER with business administration and mechanical background, age 30 up, bilingual with at least 5 years practical experience, required by an industrial engineering consultant in Montreal. Apply to File No. 3307-V.

STRUCTURAL STEEL DRAUGHTSMEN AND CHECKERS, preferably graduate engineers but any experienced men acceptable, are required for a steel fabricating company in Manitoba. Salary open. Apply to File No. 3519-V.

ASSISTANT PLANT ENGINEER with paper mill experience required by a pulp and paper company with plants in Eastern Canada. Salary open. Apply to File No. 3549-V.

GRADUATE ENGINEERS, recent graduates up, preferably with pulp and paper experience, required by a pulp and paper firm in the St. Maurice Valley, to work under Chief Engineer and Senior Designer on long range modern projects. Salary $3,000 up. Apply to File No. 3573-V.

GRADUATE ENGINEERS, required by a large industrial and chemical organization with headquarters in Montreal for all phases of research design, operation, development, production and maintenance. Salaries open. Apply to File No. 3588-V.

PROFESSOR in machine design, required for fall term by a university in Central Ontario. Salary open. Apply to File No. 3600-V (F).

CHIEF ENGINEER with industrial experience required for a steel fabricating plant in Western Canada. Salary open. Apply to File No. 3616-V.

STRUCTURAL AND MECHANICAL DRAUGHTSMAN required for detail drawings by a steel fabricating plant in Western Canada. Salary open. Apply to File No. 3616-V.

DESIGN DRAUGHTSMAN for the design of cranes and hoists of all types, capable of making and checking complete manufacturing detail drawing, required by a manufacturer in Southern Ontario. Apply to File No. 3628-V by letter with full details. Salary open.

SALES ENGINEER with wide engineering experience wanted by a company in Toronto for the sale of textile machinery and construction equipment. Salary open. Apply to File No. 3639-V.

STRUCTURAL DESIGNERS AND DRAUGHTSMEN required by a firm of consulting engineers in Montreal. Salary open. Apply to File No. 3668-V.

JUNIOR ENGINEERS, recent graduates up, as designing draughtsmen for a brewing company with headquarters in Montreal. Salary from $200. Apply to File No. 3670-V.

JUNIOR ENGINEERS, recent graduate up, required for the engineering staff of a communications company with headquarters in Montreal. Veterans preferred. Salary from $175. Apply to File No. 3713-V.

MINING AND METALLURGICAL ENGINEER, age about 30, with considerable experience, required by a manufacturer in the St. Maurice Valley. Salary open. Apply to File No. 3723-V.

CIVIL ENGINEERS AND ASSISTANT HYDRAULIC ENGINEERS required for government organization on West Coast for highway and construction. Salary open. Apply to File No. 3724-V.

CONSTRUCTION ENGINEER with considerable experience required for the permanent staff of a Montreal inspection company. Salary about $200. Age immaterial. Apply to File No. 3728-V.

DETAILER AND DESIGNER for reinforcing steel with considerable experience required by a steel fabricating firm in Montreal. Salary open. Apply to File No: 3740-V.

STRUCTURAL STEEL DETAILER AND CHECKER with considerable experience required for checking shop details by a steel fabricating firm in Montreal. Salary open. Apply to File No. 3740-V.

DESIGN ENGINEERS, age about 30, with experience in the design and layout of chemical plants, required by an industrial organization in the St. Maurice Valley. Salary from $250. Apply to File No. 3741-V.

DESIGN DRAUGHTSMEN, age about 25, with experience in chemical plant layouts, required by an industrial organization in the St. Maurice Valley. Salary from $200. Apply to File No. 3741-V.

GRADUATE ENGINEERS, recent graduates up, preferably mechanical, required for the engineering and operating staff of a pulp mill in Eastern Quebec. Salary open. Apply to File No. 3748-V.

PUBLICITY ENGINEER required by an electrical firm in Montreal to organize publicity department and edit trade journal. Salary open. Apply to File No. 3751-V.

TECHNICAL GRADUATE, preferably Mechanical, Chemical or Electrical, under 30, veteran preferred, for permanent position with engineering organization. Training period in U.S. Work will include travelling for consultation among leading industrial plants. Enclose photo when answering. Salary open. Apply to File No. 3759-V.

CIVIL, MECHANICAL OR CHEMICAL ENGINEERS, recent graduates up, preferably with experience in petroleum and heavy industry such as chemical or paper, required by an oil company in Toronto. Salary open. Apply to File No. 3762-V.

BRIDGE ENGINEER, qualified to be in charge of the design and supervision of the construction of highway bridges. Apply stating qualifications, experience, age and salary wanted to File No. 3780-V.

GRADUATE CIVIL OR MECHANICAL ENGINEERS with 3 to 10 years experience in design, cost estimates, draughting, and engineering studies for a large hydro-electric power house in Quebec. Salary $225 up. Apply to File No. 3787-V.

STEAM PLANT ENGINEER for large concern in Eastern Townships, with at least 5 years practical experience. Must be familiar with thermo-dynamics, combustion control, steam turbines, mechanical refrigeration, hydraulics, etc. Permanent position and attractive salary for the right man. Apply to File No. 3791-V.

RECENT GRADUATES OR JUNIOR ENGINEERS with mechanical background, required by a Montreal Engineering, fabricating and contracting firm for training purposes leading to sales and service. Area Montreal. Salary $175 up. Apply to File No. 3810-V.

STRUCTURAL ENGINEER, required by a firm of consulting engineers in Montreal for design work. Must have experience in structural steel and reinforced concrete. Salary open. Apply to File No. 3811-V.

CHIEF ENGINEER required for coal stripping and mining operations in Alberta, would also have responsibilities in highway construction in this Province. Minimum salary $6,000. Apply to File No. 3814-V.

ASSISTANT GENERAL MANAGER to be in charge of all coal development operations in Alberta and some highway contracts. Salary $8,000 to $10,000. Apply to File No. 3814-V.

INDUSTRIAL ENGINEER with broad experience in plant development, operation, costs and management required for a firm in Quebec. Salary from $250. Apply to File No. 3818-V.

GRADUATE ENGINEER, preferably with chemical and industrial experience, required to supervise operations at the Sodium Sulphate Plant now being constructed at Chaplin, Sask. Salary open. Apply to File No. 3821-V.

DRAUGHTSMEN required by a pulp and paper mill in the Eastern Townships for general draughting and detailing. Three or four years experience preferred but not essential. Salary open. Apply to File No. 3823-V.

DRAUGHTSMAN, preferably with mechanical background, required by a manufacturer in Montreal for design work on electrical equipment. Salary open. Apply to File No. 3829-V.

DEPUTY DIRECTOR OF IRRIGATION, Ceylon, must be Corporate Member of the Institute of Civil Engineers or possess degrees or diplomas recognized by that body. Technical duties include designing, estimating for and reporting on schemes of irrigation water supply and flood protection and checking the construction costs of such schemes. Apply to File No. 3834-V.

CONSTRUCTION ENGINEER with carpenter foreman or supervisory experience required by an Engineering and Contracting firm in Montreal. Salary around $500. Apply to File No. 3838-V.

GRADUATE ENGINEER, age 35-40, with 10 years experience in building construction and general contracting work; to supervise design, construction and maintenance of structures for Public Utility in Toronto. Permanent job. Salary open. Send photo and full particulars of education and experience. Apply to File No. 3847-V.

APPLICATION FOR GRADUATE ENGINEER

Application for a young Graduate Engineer will be received at the Office of the City Clerk, City Hall, Fort William, Ontario, until 12 o'clock noon, Saturday, August 9th, 1947, a position which is at present vacant, in the Engineering Department of the City of Fort William.

Applicants are requested to state their age, qualifications, experience and salary expected.

Preference will be given to ex-service personnel in the selection of this position, and knowledge of Municipal Engineering is essential. Applicants must also state whether their Certificate is approved by the Professional Engineering Association of the Province of Ontario.

D. M. MARTIN, City Clerk

THE PUBLIC SERVICE OF CANADA

Requires An

Electrical Engineer

$3,000 - $3,300

Air Services Branch, Department of Transport, Ottawa.

Full particulars on posters in Post Offices, National Employment Service Offices, or Offices of the Civil Service Commission throughout Canada. Application forms, obtainable thereat, should be filed immediately with the

CIVIL SERVICE COMMISSION OF CANADA

OTTAWA

Established Canadian Manufacturer of Fabricated Steel Products

SEEKS THREE ENGINEERS

MARITIMES: Branch manager for sales in the three maritime provinces, age 32-38, native to maritime, graduate civil engineer, some construction experience desirable, must wish to follow sales work although previous sales experience not essential, a real opportunity.

ONTARIO: Sales engineer for market analysis and development, previous sales experience desirable, analytical mind, mature judgment, age 32-38.

MANITOBA: Sales engineer for selling and technical promotion of construction products, opportunity for key post, age over 30, some construction experience an advantage.

State full qualifications first letter.

Apply to File No. 3883-V.

Professional Engineer

REQUIRED

Familiar with industrial processes, metallurgical and chemical engineering as applied to steel, copper, mining and chemical plants.

Broad general experience in estimating and designing. Emphasis will be placed on ability rather than detailed knowledge.

Remuneration . . . according to ability.

Apply in writing outlining specifications to File No. 3886-V.

THE PUBLIC SERVICE OF CANADA

Requires

CIVIL ENGINEERS

$3,600 - $4,200 and $3,000 - $3,600

Department of Mines and Resources at Ottawa and Banff

Department of Public Works at Ottawa and Various Centres

Full particulars on posters in Post Offices, National Employment Service Offices, or Offices of the Civil Service Commission throughout Canada. Application forms, obtainable thereat, should be filed immediately with the

CIVIL SERVICE COMMISSION OF CANADA
OTTAWA

UNIVERSITY OF TORONTO

REQUIRES

Engineer Instructors

Instructors of various grades up to and including lecturer are required by the Faculty of Applied Science and Engineering of the University of Toronto for duty starting in September, 1947. Applicants must be engineering, science, or mathematics graduates. Salary will depend on experience and general qualifications.

Apply to the Secretary of the Faculty of Applied Science and Engineering, Mining Building, University of Toronto.

MAINTENANCE SUPERINTENDENT required by an industrial organization in Montreal to supervise the maintenance of wharves, buildings, conveyors, ships, loading and discharging equipment at Port Alfred docks. Salary $350 up. Apply to File No. 3848-V.

JUNIOR INDUSTRIAL ENGINEER, with mechanical or chemical background, preferably with knowledge of chemical plants, required in Montreal. Salary $250 up. Apply to File No. 3857-V.

DRAUGHTSMEN of the following classes: Architectural, piping layout, equipment layout, mechanical design, steam plant, heating, and ventilating, electrical and plumbing required by an industrial organization in Montreal. Salaries open. Apply to File No. 3860-V.

Situations Wanted

EXPERIENCED GAS ENGINEER

Sixteen years experience in Natural and Mixed gas industry. Qualifications; B.A.Sc. Toronto, M.E.I.C., R.P.E., O.L.S., Member American Gas Association.

Thoroughly experienced in pipe-line and compressor station design and construction, corrosion, gas measurement problems etc., and utilization, production and distribution practice.

Well known throughout the industry in Canada and U.S.A. Age 39. Presently employed but considering change if sufficiently attractive offer made.

All enquires of course will be confidential. Apply to File No. 546-W.

GRADUATE HIGHWAY TRAFFIC AND TRANSPORTATION (Yale) and CIVIL ENGINEER (U.N.B.), Jr. E.I.C., age 26, married, several years experience, primarily in highways. Is interested and trained for traffic engineering positions in the following departments—police, city planning, city engineering, provincial highways; also in consulting engineering, transit and transportation companies, and Safety work with Safety and Insurance Organizations. Apply to File No. 184-W.

SECOND YEAR ENGINEERING STUDENT at McGill University, S.E.I.C., forced to abandon, would like to be trained as a sales engineer by a responsible concern. Age 23, single, good appearance and personality, free to travel and bilingual. Apply to File No. 339-W.

GRADUATE CIVIL ENGINEER, M.E.I.C., age 42; P. Eng. in B.C., ten years experience as superintendent and engineer on large building construction, two years design and installation of waterworks, two years municipal and seven years administrative experience. Thoroughly familiar with manufacturing problems, cost accounting, production control, time study and methods, plant layout etc. Excellent record of accomplishment and earnings. At present employed but seeking a permanent position in one of the larger centres of the west coast. Apply to File No. 880-W.

MECHANICAL ENGINEER, M.E.I.C., P.E. Ont., 10 years' experience chemical industry of Ontario. Wishes to locate in West. Apply to File No. 1309-W.

CIVIL ENGINEER, M.E.I.C., P.E.Q., would accept work at night. Design and checking of reinforced Concrete structures, estimates, Hydraulic. At present employed in Montreal. Apply to File No. 1527-W.

SALES ENGINEER, Jr.E.I.C., Prof. Eng. Ont. '36 McGill, wants to sell reliable engineeriug equipment. Agressive, bilingual, age 32, Good engineering background. Apply to File No. 1698-W.

ELECTRICAL ENGINEER, M.E.I.C., with twenty years experience in Sales and Technical Service of Electrical Machinery and Allied Equipment and at present manager of his department, is looking for position with a broader horizon. Apply to File No. 1854-W.

HYDRAULIC ENGINEER, B.Sc., M.E.I.C., 20 years experience in Hydraulics relative to hydro-electric power development, hydraulic machinery design and manufacture and development in hydraulic turbine design. Experience in handling men. Desires change in position. Apply to File No. 2638-W.

ELECTRICAL-MECHANICAL ENGINEER, Jr. E.I.C., age 30, graduate of Naval Electrical Engineering Officers course at Nova Scotia Technical College, 1945. Graduate of Naval Electrical Artificer's course at University of Alberta, followed by 6 months of instructional work on same. One year at sea as Chief Electrical Artificer on frigate in charge of all electrical equipment. Completed apprenticeship as machinist in railway repair shops in design work testing, research and calculations. Available on two weeks notice. Apply to File No. 2693-W.

METALLURGICAL ENGINEER, M.E.I.C., with 13 years' experience in light metals, copper, zinc and their alloys, would like to change his position. Experience covers remelt, extrusion, rolling and drawing. Operating as well as research and development work and technical sales service. Interested in a responsible position primarily in sales development work. Would be available on a 2 month notice. Age 39, married, bilingual. Apply to File No. 2844-W.

MECHANICAL ENGINEER, Jr.E.I.C., graduate Queen's 1945, age 24, single. For three summers employed in auto plant maintenance. One year and a half experience in designing and draughting of Hydraulic and Plastic Machinery, estimating. Desires responsible position connected with production or industrial maintenance with a smaller progressive company. Prefers Ontario or Western area. Apply to File No. 2849-W.

CHEMICAL ENGINEER, Jr.E.I.C., McGill '27, married. Experienced manager, in charge personnel, production, purchasing. Synthetic resin research, distillation. Plant and laboratory control, time study, sales. Available immediately. Bilingual. $4,500. year last position. Apply to File No. 2850-W.

CIVIL ENGINEER, M.E.I.C., O.L.S., R.P.E., B.Sc., age 27, single, ex-R.C.E. officer desires position with Canadian or American firm engaged in structural engineering work to do design, layout and supervision of construction in Canada or foreign countries. Apply to File No. 2851-W.

YOUNG STATISTICAL METHODS ENGINEER, Jr. E.I.C., B.A.Sc., would accept some consulting work at night or Saturdays. Thoroughly familiar with statistical analysis of data, sampling inspection plans and charting methods for process, quality or material control. Actually employed as a technical advisor in statistical methods by a large industrial plant in Montreal. Apply to File No. 2862-W.

RECENT GRADUATE IN ENGINEERING Physics, S.E.I.C., B.A.Sc. Toronto, age 23, single. Specialized in Electricity and Communications, 1 year experience in Electrical Field, available for Permanent position. Apply to File No. 2869-W.

CIVIL ENGINEER B.A.Sc. Toronto 1940. Jr. E.I.C., P.Eng. Ontario. 7 years experience plant maintenance, cost analysis and project development in small part machining and sheet metal industry including all phases of forming and welding. Desire this type of work in Toronto area. Apply to File No. 2870-W.

MECHANICAL ENGINEER, Jr. E.I.C., P.Eng., (Ont.), graduate of the U. of Sask., '42 with distinction ,Member of American Society for Metals, age 28, single. Five years experience in machine shop production and methods, changes in tool and product design, heat treating, inspection and testing of metals and materials; ore and oxy-acetylene welding; foundry problems in cast iron, brass, bronze, malleable iron and die castings. Completed a two year engineering apprenticeship course in a large manufacturing plant. First prize for technical paper. Health excellent. Willing to work on probation for one month. Desires position to utilize the above experience. Apply to File No. 2871-W.

PRELIMINARY NOTICE

(*Continued from page 359*)

SHARPE—HARRY WILLIAM, of North Bay, Ont. Born at Peterborough, England, Oct. 7, 1898. Educ.: I.C.S.; Member, A.S.M.E., (on basis of professional record and credentials); 1914-16, Canadian Pacific Rly., carman, bolt machine operator, drilling machine operator, safety app. insptr., steel repair gang, layout, special constrn. work; with T. & N.O. Railway, (now Ontario Northland Rly.), as follows: 1916-27, dftsman., mech. dept., designing, redesigning of locomotive parts, specifications, 1927-31, designing of pressure gauges, safety valves, special valves for superheated steam operation, fullest authority in mfg. details, participated in loco. performance tests, etc., (in 1931 due to effects of depression was given leave of absence); 1931-35, free lance designing and dftng. work for various firms; 1935, resumed former position as mech. dftsman. with Ontario Northland Rly., 1939, chief dftsman., i/c designs for locomotives, passenger cars, freight car shops, shop tools, shop equipt., writing of specifications for new equipt., etc., and at present ,mech. engr., mech. dept., North Bay, Ont.

References: H. M. Esdaile, J. G. Hall, L. H. Birkett, H. C. Karn, W. O. Collis.

TOBIAS—ALEXANDER, of Toronto, Ont. Born at Toronto, Ont., July 25, 1913. Educ.: I.C.S., (structl. engrg.); R.P.E., Ontario, (by exam.); 1913-33. dftsman., B. Swartz, architect; 1934-38, dftsman., National Steel Works, Toronto; 1938-39, dftsman., checker, Standard Iron & Steel Works; 1939-43. dftsman. & checker, Dominion Bridge Co., Toronto; with Standard Iron & Steel Works, Ltd., Toronto, as follows: 1943-45, asst. chief engr., 1945 to date, chief engr.

References: G. L. Wallace, L. A. Badgley, E. A. Cross, F. Wellwood, C. D. Carruthers, J. McLellan.

WISE—JACK MYRON, of Assiniboia, Sask. Born at Medicine Hat, Alta. Nov. 9, 1924. Educ.: B.Sc., (Mech. Engrg.), Saskatchewan, 1947; 1943-44-45. (summers—May to Sept.) jr. engr., Civilian Ground Crew, No. 34 E.F.T.S., Assiniboia; driller's asst., exploration dept.; geological asst., Imperial Oil Limited.

References: I. M. Fraser, N. B. Hutcheon, A. L. C. Atkinson, R. A. Spencer E. K. Phillips.

LIBRARY NOTES

(*Continued from page 358*)

REFRIGERATION, Theory and Applications:

H. H. Venemann. 2 ed. Nickerson & Collins Co., Chicago, 1946. 336 pp., illus., diagrs., charts, tables, 9¼ x 6 in., cloth, $4.00.

The refrigerating field is broadly covered. The several chapters deal with thermodynamic fundamentals, various refrigerants, the important mechanical parts and their operation, and practical information on plant operation. Particular attention is paid to automatic controls, the analysis of actual plant performance, and estimating and accommodating plant loads. The final chapter discusses specifications for refrigeration plant, and a group of 12 supplementary charts are in a pocket inside the back cover.

ROCKETS and Space Travel, the Future of Flight Beyond the Stratosphere:

W. Ley. Viking Press, New York; Macmillan, Toronto, 1947. 374 pp., illus., diagrs., charts, tables, 8½ x 5½ in., cloth, $4.50 (in Canada).

Beginning with the early concepts of space travel and conditions beyond the limits of the earth's atmosphere, the author proceeds to a discussion of the actual and practical development of the rocket as a means of motive power. The new edition presents an extensive account of the German experiments which lead to the V-2 weapon. Considerable space is devoted to the technical and physiological problems connected with the take-off and controls for space flight. A technical data section and a bibliography are appended.

Society for EXPERIMENTAL STRESS ANALYSIS, Proceedings Vol. IV, No. 1:

Edited by C. Lipson and W. M. Murray; published and distributed by Addison-Wesley Press, Inc., Kendall Square, Cambridge 42, Mass., 1946. 129 pp., illus., diagrs., charts, tables, 11¼ x 8¼ in., cloth, $6.00.

The current volume of this semi-annual publication contains twelve papers by specialists. Topics covered include strain rosette analyses and computations, stress studies of various mechanical structures, brittle lacquer indications of residual stresses, impact on prismatical bars, and the pressure of plastic concrete in forms. A list of members of the Society is included.

TABLES OF INTEGRALS AND OTHER MATHEMATICAL DATA:

H. B. Dwight. rev. ed. Macmillan Company, New York and Toronto, 1947. 250 pp., diagrs., charts, tables, 8½ x 5¼ in., cloth, $2.50.

Classified groups of derivatives and integrals are given for algebraic, trigonometric, exponential, logarithmic, hyperbolic, elliptic, and Bessel functions. Inverse trigonometric and hyperbolic functions are also covered, as are probability integrals, surface zonal harmonics, definite integrals, and differential equations. Tables of numerical values for various functions, logarithms, constants, etc., are appended, and there is a list of references.

TUNGSTEN; Its History, Geology, Ore-Dressing, Metallurgy, Chemistry, Analysis, Applications and Economics. (A.C.S. Monograph No. 94):

K. C. Li and G. Y. Wang. 2 ed. rev. and enl., Reinhold Publishing Corp., New York, 1947. 430 pp., illus., diagrs., charts, maps, tables, 9¼ x 6 in., cloth, $8.50.

Following a detailed description of the geology and mineral deposits of tungsten, the author deals successively with its ore dressing and metallurgy, physical and chemical properties, and the various analytical methods for its determination in ores and metals. The industrial applications of tungsten are considered at some length, with discussion of reasonably effective substitutes particularly in high-speed steel alloys. A final chapter deals with the economic aspects of the tungsten market. Extensive chapter bibliographies are provided.

THE ENGINEERING JOURNAL

THE JOURNAL OF THE ENGINEERING INSTITUTE OF CANADA

VOLUME 30 | MONTREAL, AUGUST 1947 | NUMBER 8

"To facilitate the acquirement and interchange of professional knowledge among its members, to promote their professional interests, to encourage original research, to develop and maintain high standards in the engineering profession and to enhance the usefulness of the profession to the public."

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CONTENTS

PUBLISHED MONTHLY BY

THE ENGINEERING INSTITUTE OF CANADA

2050 MANSFIELD STREET - MONTREAL

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Price $4.00 a year in Canada, British Possessions, United States and Mexico. $5.50 a year in Foreign Countries. Current issues, 50 cents a copy, back issues 75 cents a copy. To members and affiliates, 25 cents a copy, $2.00 a year.—Authorized as second class mail, Post Office Department, Ottawa.

COVER PICTURE

The cover photo is of the De Havilland Vampire II or "Nene-Vampire" jet fighter. Installation of the Rolls-Royce Nene engine results in an improved take-off, climb and ceiling and the aircraft is stated to have recently established an unofficial height record of 51,000 ft. Readers familiar with the Vampire will note the added air intakes behind the canopy for delivery of air to the rear of the double sided "Nene" compressor.

THE ENGINEER AND THE COMMUNITY

A SYMPOSIUM

Foreword—*The three addresses printed herewith make up a symposium presented at the Annual Meeting of the Institute in Toronto on May 8th, 1947, under the general heading of "The Engineer and the Community—A Symposium".*

Purposely all papers are general in character, and in particular the last two deal with engineering attainment and prospect from a somewhat different angle than any of those to which the engineer may have become accustomed.

Mr. Kerry's paper is a masterpiece of history and philosophy, which will hold the attention of any Canadian engineer. Mr. Thomson treats his share of the subject from the point of view of industrial production using the record to indicate the ability and potential of the profession today. It is itself a record that will be useful to many people. Mr. Taylor emphasizes the moral needs of the world of the future, pointing out the peculiar qualities of the engineer which indicate that he should take a leading part in their solution.

THE PAST

A Chronology of Early Canadian Engineering Activities

J. G. G. KERRY, M.E.I.C.,
Consulting Engineer, Port Hope, Ont.

Tracing the history of Canadian engineering as far back as the war of 1812, the author describes the successive waves of construction activity which followed in the wake of political events; the canal building period of the 1820's, 30's and 40's, the railway building era and Montreal Ship Channel in the "fifties", the C.P.R. construction in the 70's. The organization of the Canadian Society of Civil Engineers in the late eighties is outlined and a chronology given of its growth, with personal sketches of the successive secretaries. Reasons are given for the change of name from "Society" to "Institute". The development of the system of Branches is described and the growth and development of Provincial Associations of Professional Engineers, and their affiliation with the Institute, is told.

It is no easy task to condense the history of The Engineering Institute of Canada into a limited space. The life of the Institute covers sixty years, crowded with notable achievements and lighted up by vivid personalities. Yet the story would be incomplete if it did not also include some notice of the earlier achievements of Canadian engineering and of the careers of the outstanding men who founded the Institute. Throughout the long history there runs a curious parallel between the periods of political crisis in Canada and the surges of engineering activity within its borders. Each notable political crisis has been followed by bold construction enterprises, and by insistent demands for further service from the engineer.

Canal Building in the Period 1820-1860

The story may be said to have commenced with the war of 1812-1815, when Canada's regard for her neighbours to the south was by no means as friendly as it is today. That war had made clear to all Canadians how difficult it was to move the men and the materials necessary to the defense of Canada to the several localities where they were needed. The termination of the war was therefore followed by many efforts to improve the transportation facilities of the country. These efforts were put forth by private capital and by the British Government. They all were directed towards the creation of an adequate canal system. The Lachine Canal, the Chambly Canal and the Welland Canal were undertaken by chartered companies and finally carried to completion, though not without resort to government assistance. To the members of the Institute today, perhaps the most interesting historical item is that the first President of the Welland Canal was one George Keefer, and that two of his sons worked on the building of that canal during the 1820's. One of these two boys was at long last to become the second president of the Canadian Society of Civil Engineers. A younger brother of those two boys was to become the first President of the Society.

The second series of canals, generally known as the military canals, were planned to follow the Ottawa, Rideau and Trent Rivers, and to establish safe transportation between Montreal and a terminal at Penetanguishene. The terminal site at Penetanguishene is still in the ownership of the Crown, in the right of the Province of Ontario.

A brief story of these canal enterprises will be found in the omnibus report published by the Department of Public Works in 1868, after Confederation. This report reviewed all the public works that had been constructed by the United Canadas, and the other colonies. Reference may also be made to a small volume, "Canals in Canada", written by the historian Dr. W. Kingsford. Dr. Kingsford was himself a civil engineer who had seen service in the canal system. He was a member of the Institute from the date of its organization until his death in 1898. Dr. Kingsford's major work, his History of Canada, was written in the last decade of his life, whilst he was a member of the Institute.

The City of Ottawa, once called Bytown, is full of memories of the builder of the military canals, Lt. Col. By, R.E., and the contemporary Professional Papers of the Royal Engineers contain interesting articles dealing with construction experiences on those remote undertakings.

The first burst of activity in canal building quieted down early in the 1830's largely because the Canadas were then undergoing a political upheaval which did not terminate until after the acceptance of Lord Durham's report, and the establishment of a new system of government for the colonies. To the members of this Institute probably the most interesting of the Durham papers is a report by Lt. Col. Phillpott, R.E., on the St. Lawrence Canals. To read Col. Phillpott's report today is to find that the hopes and objectives of one hundred years ago were much the same as we dream over ourselves today. Nothing has changed except the magnitude of the works to be built and the size of the vessels to be accommodated. This report may well be called the first official report of the St. Lawrence Deep Waterway.

The new Union government which was formed in 1841 endorsed Col. Phillpott's general programme. Its Board of Public Works, with H. H. Killaly as Chairman and Samuel Keefer as Chief Engineer, went promptly to work on the enterprise. Mr. Samuel Keefer was to become the second President of the Canadian Society of Civil Engineers, while his assistant and successor, Mr. John Page, who remained in office until his death in 1890, has the distinction of being the one member of the Society who accepted nomination to its presidency and who for departmental reasons was forced to withdraw his consent, a unique incident in the history of the Institute.

Railway Building in the "Fifties"

A brief check to all engineering activities came in 1849, when the British Government caused widespread consternation in Montreal by repealing the Corn Laws, thereby depriving Canada of certain lucrative and highly valued privileges in the British market. But hope and energy returned with the completion of the short-lived reciprocity treaty with the United States, and with the resulting upsurge of commercial activity came the building of railroads, the major field of engineering activity during the 1850's. The principal item of construction was the Grand Trunk Railway, and the era came to a temporary halt with the opening of the Victoria Bridge at Montreal in 1860. Sir Casimir Gzowski, who was to become the third President of the Society, and Sir Sandford Fleming were among the more prominent of the engineering leaders of that time.

At the beginning of the same decade the merchants of Montreal determined to create the Montreal Ship Channel, a work which had been begun by the Government in the 1840's and abandoned for fear of silting up. The Montreal Harbour Commission under the leadership of the Hon. John Young, and with T. C. Keefer as engineer, took over the abandoned works and carried them to the completion of their first objective. It was a courageous undertaking, because the Commission had nothing but the revenues of the port to depend on for financing. The present harbour of Montreal stands as a monument to their enterprise and courage. The channel has been almost continuously in process of further deepening since that date. Mr. T. C. Keefer, with the assistance of Mr. Louis Lesage, M.E.I.C., was also busy during the same years building the Montreal Aqueduct and enlarging the water supply system in Montreal.

The "Intercolonial"

About 1860 another halt in engineering activity was experienced, partly because the Canadas were locked in a political stalemate, which ended only when Confederation was achieved in 1867. Another reason for inactivity was that all business in Canada was greatly affected by the battle for supremacy between the Northern and Southern States of the United States of America, which was then in progress. With the advent of peace and the creation of the Dominion of Canada came another outburst of engineering activity. Many efforts had been made to commence the construction of the Intercolonial Railway but all had failed in securing the necessary financial backing. It remained for the Act of Confederation to commit both the Canadian and the British Governments to the enterprise, which was immediately pushed vigorously to completion under the direction of Sir Sandford Fleming, who has published a full record of his stewardship. One fact pleasing to all Canadians is that the British Government was never called upon in any way to implement its guarantees of the funds used in this enterprise.

The new Canadian Government also undertook the enlargement of the canal system, acting upon the advice of a special commission headed by Sir Hugh Allan. This was the enlargement that called forth Mr. T. C. Keefer's jibe that "Canada always builds her canals to plans that are obsolete before construction is commenced". Many a true word is spoken in jest and the present generation of engineers should be on the alert to see to it that history does not repeat itself, for the official plans of today are certainly obsolete.

The Canadian Pacific

An even greater engineering achievement was commenced when in 1871 Sir John MacDonald startled the country by undertaking to build a Canadian Pacific Railway main line within ten years from the date of the entry of the Province of British Columbia into Confederation. The job was actually accomplished in fifteen years. How great an undertaking that was at the time may be fairly well judged by anyone who will read Dr. Geo. M. Grant's book "Ocean to Ocean", recording all the happenings on a special journey, made at the request of the Canadian Government in 1872 by Sir Sanford Fleming and Dr. Grant from Halifax to Victoria, to study routes for the proposed railway.

With the completion of the C.P.R. main line there came another lull in engineering activity and for a time many of the Society's younger members had to wend their ways into the United States looking for employment.

Opening Up of The West

Towards the end of the "nineties" the activities of the Canadian Pacific Railway and the Canadian Government, guided by the organizing genius of Sir Clifford Sifton, were creating a new Canadian world west of the Great Lakes, and the call for engineers again became insistent and for activities over an ever wider range of technical enterprise. If the reader will look over a group of papers dealing with telegraphs, telephones and electric lighting which were presented to the Society in 1888, he will realize from their phraseology that new ground was then being broken. It may be said with little inaccuracy that the art of utilizing electricity in many different ways reached its first great era of expansion during the 1890 decade. Mr. T. C. Keefer, in his presidential address delivered in January 1888, divided the work of the profession into railways, canals, river improvements, harbours and lighthouses, water supply, sewerage, pavements, tramways, mechanical, wiring and electrical. He notes that the total capital invested in the electric light industry at that time had reached the great sum of two million dollars!

The field of the engineer has in fact been a continuously expanding one, ever since the formation of the Society in 1887, and it is out of the question even to attempt to enumerate all the works of high engineering merit that have been constructed in Canada since that date.

Some Outstanding Western Engineering Projects

The speaker may be forgiven if he refers to a few of these projects that have appealed to him personally as being of more than ordinary importance. These works make up a rough chronicle of engineering progress. The order in which they are stated is strictly geographical. The list that follows at least indicates how great are the improvements which have been made in one man's lifetime.

The Lake Buntzen hydro-electric power development in Burrard Inlet was built about 1903 for the B.C. Electric Railway. Subsequently it was enlarged under the direction of G. R. G. Conway, M.E.I.C., and may be regarded as the foundation stone of the present B.C. Power Corporation Limited. This plant was perhaps the first successful example in Canada of the diversion of the flow of a river to a naturally attractive site for power development,—a type of development for which British Columbia still offers many opportunities.

The location of the line of the Canadian Northern Railway from Vancouver to the Yellowhead Pass is a work particularly associated with the name of T. H. White, M.E.I.C. This is a masterly development of a railway route across British Columbia that was first reported upon by two young Englishmen travelling on an independent venture in 1863, prompted by Imperial vision. The route was subsequently studied and approved of by Sir Sandford Fleming. It was later rejected by the Canadian Pacific Railway Company's construction authorities, and finally adopted by Messers. MacKenzie and Mann for their transcontinental connection in the first decade of this century.

About the same time the spiral tunnels in the Kicking Horse Pass on the Canadian Pacific Railway were built, the construction of which did much to reduce the cost of handling the eastbound traffic of that railway across the Rocky Mountains divide. The plans for this grade reduction were worked out by A. C. Dennis, M.E.I.C., then a member of the Construction Department of the Canadian Pacific Railway, and the details of the layout attracted widespread engineering comment.

The irrigation system built by the Canadian Pacific Railway in the Province of Alberta was built about 1912 under the direction of J. S. Dennis, Past President, and it included the Bassano Dam across the Bow River, a notable example of dam construction on a questionable foundation. It is realized today that the full development of the possibilities of the Prairie Provinces in the future depends on the application of Mr. Dennis' principles to much wider areas.

The natural gas supply system to Calgary was built by Dr. Eugene Coste about 1912, and was the first full-scale demonstration of the underground riches of the Prairie Provinces. Dr. Coste was not a member of the Institute but was closely associated with his brother Louis Coste who was very active in Society affairs.

The Winnipeg Aqueduct was built in 1913-1918 under the direction of W. G. Chace, M.E.I.C., with J. H. Fuertes, M. Am. Soc. C. E., as Consulting Engineer. This aqueduct, about 85 miles long, carries water by gravity from Shoal Lake (Lake of the Woods) to a supply reservoir for the City of Winnipeg. Its dimensions vary with the natural slope of the prairie over which is was built. It relieved a quite severe shortage of water supply in Winnipeg and the surrounding municipalities. This enterprise was first discussed when Mr. Ruttan, Past President, was City Engineer of Winnipeg.

The construction of the Canadian Pacific Railway's main line north of the Great Lakes was completed in 1885. The most unapproachable section of this work, extending from Mattawa to the Missinabie River, was in charge of W. A. Ramsey, M.E.I.C., as Chief Engineer. Over the uncompleted line moved the Canadian forces that crushed the Riel rebellion in 1885. This work had no outstanding features, its difficulties arising from its remoteness and the severity of the winters along the height of land between the Great Lakes and Hudson Bay. In spite of these difficulties it was completed in advance of the date of the laying of the last rail on the main line across British Columbia. It remains a notable example of well planned construction management.

Outstanding Projects In Eastern Canada

The Hydro-Electric Power Supply System in Ontario may be said to have originated when the Canadian Niagara Power Company started to build its plant on the Canadian side of the Niagara River about the year 1900, under the local superintendence of C. B. Smith, M.E.I.C. Independent developments by the Ontario Power Company and by the Toronto and Niagara Power Company followed somewhat quickly. Mr. Smith became Chairman of the first Hydro-Electric Power Commission of Ontario, which carried out an extensive series of water power surveys over the settled portions of the Province. This Commission outlined general plans of development that have been followed by the second and presently existing commission of which Mr. Smith was the first Chief Engineer. The Chippewa power development on the Niagara River, and the transmission lines connecting with hydro-electric development in the Province of Quebec, are outstanding features of the present system. Dr. F. A. Gaby, Past President, as Chief Engineer, and H. G. Acres, M.E.I.C., as hydraulic engineer, had charge of many notable pieces of construction for the Commission.

The hydro-electric development of the Ottawa Electric Light Company and associated companies at the Chaudiere Falls of the Ottawa River was one of the pioneer electric developments in Canada. Few sites have provided more ice troubles than did this one before the present dam was built across the head of the Chaudiere Falls. The profession learned much from the experiences of the operation of these early plants in the 1890's. A Dion, M.E.I.C., as manager of the company, and John Murphy, M.E.I.C., as superintendent were particularly active in combatting its difficulties.

The development of the copper-nickel industry around Sudbury has had a wide influence on Canadian development. In 1885 it was generally known in the pioneer settlement of Sudbury that extensive areas were being taken up in that neighbourhood for their copper producing possibilities. Yet no work was in progress and the word nickel was never heard. By the end of 1887 Sudbury was well on its way to becoming a town of importance, and the growth of its industry has proceeded almost without check ever since. The ore in this great basin is a very complex one, and many metallurgical problems called for solution before the nickel industry attained the position of prominence and usefulness to the engineer that it now holds. The names of C. V. Corless, M.E.I.C., and his associates in the Mond Nickel Company are perhaps as well known to Canadian engineers as any of those connected with this development.

The work of the Montreal Flood Commission under the guidance of Mr. T. C. Keefer and Mr. John Kennedy deserves a place in any records of Canadian engineering. The very success of the measures it recommended has contributed to carrying the high quality of its engineering studies into oblivion. It was the first truly scientific attack to be made on the ice problems of Canada and this was carried out in the 1880's. Montreal has been free from flood troubles since the Commission completed its work. The designs for the centre of Montreal harbour were a development from its studies, and the life-work of Dr. Howard Barnes on the problems of ice formation may be credited to initiative arising out of the work of the Commission.

The Montreal Ship Channel is notable for the great effect that its creation has had on Canadian trade, and for the courage, enterprise and skill of the men who undertook the first deepening of this channel, the Hon. John Young and Mr. T. C. Keefer. A very high quality of engineering work, both mechanical and civil, marked the years of development under the direction of Sir John Kennedy, Past President. The great dredging fleet that deepened that channel to 27½ feet by 1887 was very largely the creation of Sir John's mechanical genius.

The completion of the Quebec Bridge after the great disaster in 1907, and the invention of the K-truss, were triumphs of Canadian engineering which stand to the credit of Mr. Phelps Johnson, Past President of the Institute, and of his associates in the Dominion Bridge Company.

Many notable engineering works have been planned for the Maritime Provinces, but for economic reasons no one of these great undertakings has reached the construction stage. Most of the structures existing are not unusual in engineering construction, but in building harbours and bridges in the turbulent waters of the Bay of Fundy the engineer has had to overcome unique tidal conditions in a climate which is by no means friendly. The pioneer work of Mr. Martin Murphy, Past President, is entitled to high regard by all who appreciate the overcoming of special difficulties under very definite needs for economy of cost.

Early History of the Institute Itself

Turning from the history of Canadian Engineering to that of the Institute itself, the period from 1870 to about 1890 was a period of great construction activity, and it was perhaps fitting that the Canadian Society of Civil Engineers should have been chartered in 1887 at a time when these great works were nearing completion. By that date Sir Sandford Fleming had completed the Intercolonial Railway; Sir John Kennedy, who was to become the Society's fourth President, had finished the deepening to twenty-seven and a half feet of the ship channel from Montreal to tidewater; the rails of the Canadian Pacific Railway had been connected up between Montreal and Vancouver; and the enlargement of the St. Lawrence canal system was well under way.

To Alan MacDougall and Dean Bovey goes the credit of organizing the Society. Mr. MacDougall was then practising his profession in Toronto as a consulting engineer. Dr. H. T. Bovey was Dean of the Engineering Faculty of McGill University, and was a notable organizer, quick at interesting men of influence, and capable of displaying great energy in reaching an objective. The Society was fortunate in securing the leadership of Mr. T. C. Keefer, who at that time occupied a unique position in the Canadian engineering world. Mr. Keefer was then advanced in years, many of the leading engineers in the country had been his pupils or his subordinates. The list of the notable engineering works that he had created was very long, and his personality was such that he was universally esteemed both by those who had worked with him and by those in high political circles. In later years Mr. Keefer was to become President of the American Society of Civil Engineers, being the only man who has held the presidential office in both the American and Canadian national societies, and President of the Royal Society of Canada. There is a truly Canadian flavour to the first group of technical papers that Dr. Bovey secured as Secretary. These dealt with frasil ice, grain elevators, the bridge over the St. Lawrence River at Lachine, lock construction in the St. Lawrence canals, snow studies in the Selkirk mountains and with other distinctly Canadian engineering problems.

A noteworthy event was the retiring of Dr. Bovey in 1891 from the office of Secretary when Prof. C. H. McLeod stepped in to give the Institute twenty-five years of unique service. Prof. McLeod had great executive ability which was very quietly exercised, and a keen gift of penetrating the thoughts of man and of understanding the motives that guided their activities. In his long stewardship, question after question affecting the Institute came up and solutions were found for them. It was a matter of great regret to the membership generally that his early death after his retirement from office prevented him from receiving the highest honours within the bestowal of the Institute.

Following Prof. McLeod came Mr. Fraser Keith in 1917. Mr. Keith brought to the service of the Institute a mind trained in the science of engineering, a gift of enthusiastic energy, great powers of initiative and a well grounded knowledge of the workings of the technical press. His most notable contribution to the progress of the Institute lay in the creation of *The Engineering Journal*, now in its thirtieth year of publication, and one of the major braces within the structure of the Institute. It is noteworthy that the long established American Society of Civil Engineers, after a few years of consideration, decided to follow the precedent that Mr. Keith had established. It is now publishing a very acceptable monthly journal under the title of *Civil Engineering*. When Mr. Keith left the Institute in 1925 to enter a new field of activity, he carried with him the esteem and the good will of all his associates in the work of the Institute.

Prof. R. J. Durley, stepping into office in 1925, already stood high in the regard of his fellow members. He had occupied for many years the chair of Mechanical Engineering in McGill University, and had been in charge of gauges and standards for the Imperial Ministry of Munitions at Ottawa through the First Great War. He had also acted as Secretary for the Canadian Engineering Standards Association during its formative years. It fell to his lot to carry on the work of the Institute throughout the somewhat trying years that followed the financial crisis of 1929.

His resignation for reasons of ill health in 1938 was a matter of sincere regret to all who had the interests of the Institute at heart. The record of our present Secretary is too well-known to all to call for inclusion in this address, which indeed is intended to deal only with the historic past.

Provincial Recognition

The earliest effort of the Institute to secure public status took the form of a series of applications for provincial recognition. In those early days the creation of provincial barriers against members of the profession was a matter of real anxiety. This was with good reason, for jobs were not always too easy to come by in the 1890's. Many of the Institute's younger members had found occasion to look for employment in the United States during the dull years that followed the completion of the main line of the Canadian Pacific Railway. These younger members had appreciated the almost complete absence of official restraint that then obtained. Applications were therefore made to secure recognition of the professional standing of members of the Institute by various provinces. The Institute was successful in obtaining recognition from the Province of Manitoba in 1896, and from the Province of Quebec in 1898. The passage of the last named act was in considerable measure due to the personal activity of Prof. McLeod, who watched the progress of the bill through the Quebec Legislature. Similar efforts were made more than once by a committee of members residing in the Province of Ontario, but they were not successful, and the movement gradually died out. This may possibly have been because the first decade of this century was a period of great activity in all engineering circles, and the need for protective legislation did not impress itself on the members of the profession at that time.

Change From "Society" to "Institute"

The members of the Institute during its earlier years were mainly drawn from the group who today are known as civil engineers. Much thought was given to making modifications in the organization of the Institute so it would attract as members representatives of all branches of the profession. The by-laws were amended to provide for four sections,—general, mechanical, electrical and mining each with its own special officers and holding special meetings for its particular group of members. The officers of these professional sections were annually nominated by Council.

It cannot be said that these early efforts to consolidate the whole profession were particularly successful. The name "Canadian Society of Civil Engineers" was a major stumbling block, for the word 'civil' had lost its original meaning, and was no longer simply a broad distinction between the military engineer and all other members of the profession. This difficulty was largely overcome by change of name to "The Engineering Institute of Canada" which was confirmed by special act in 1918. The movement which brought about this change of name stands largely to the credit of Prof. H. E. T. Haultain. Anyone looking over the pages of the *Engineering Journal* as they now appear from month to month will realize how widely diversified is professional activity today of the Institute's many members.

When the Institute was first formed, special education to qualify a man to practice the profession of engineering was a matter of novelty and of debate. There were no well equipped schools anywhere in Canada to effectively teach the rising generation those principles of physics, mathematics and chemistry that underlie all sound engineering. A change came over this picture when the various MacDonald Technical Buildings and Laboratories were opened at McGill University about 1892. The facilities so provided attracted a teaching staff which soon acquired a world-wide reputation through the achievements of such men as Callendar and Rutherford. Other universities and institutions quickly followed the lead of McGill University, and today there are adequate provisions for the education of engineers in every part of Canada. It is not too much to say that the progress of the profession in technical knowledge now rests on the universities and the research laboratories. What the men trained to efficiently use these facilities can do to meet great emergencies has been amply demonstrated by the invaluable services given by them to their country in both the First and the Second Great Wars.

Almost the first recognition in Canada of the need that the engineer has for the assistance of the pure scientist is to be found in the employment of Dr. Howard Barnes about 1895 by John Kennedy, to investigate the problems of ice formation that were then baffling him. The old prejudice against the college man in engineering did not die out quickly, and when Dr. Bovey was nominated for the presidency of the Institute in 1899 an opposition ticket was launched, partly on the cry that the highest office in the gift of the Institute should not be given to a college professor. This cry, however, did not win much support from the members of the Institute and was soon forgotten.

Development of Branches

In its early days the activities of the Society were almost entirely centred in headquarters, where all meetings were held and all papers presented. The need of organization outside of Montreal was first recognized at the Annual Meeting in 1904 when a resolution was passed calling upon Council to consider the establishment of branches in the larger centres of population. The formation of a branch in Sydney, N.S., was reported to the Annual Meeting in 1906, but this branch was not long lived. The formation of the Toronto Branch under the chairmanship of Mr. E. A. Keating a past President of the Institute, was reported to the Annual Meeting of 1907, and this was followed by the formation of branches in Winnipeg and in Quebec which were reported in 1908. By 1920 the number of branches had grown to eighteen and the then President suggested an objective of fifty. The number now stands at 28.

The field of activity of the branches in their earlier years was a very limited one, as a study of the by-laws of the Society existing in 1908 will reveal. The growth of the Institute since that date has been marked by a steady decentralization of authority and privileges. The movement to secure equality of the branches within the Society was initiated by Toronto members at the Annual Meeting in 1908, and has continued to develop ever since. With it have come the elections of Vice-Presidents and Councillors on a territorial basis, the selection of the President from different sections of the Dominion, and the holding of the Annual Meeting of the Society at the various centres where engineers are most active. The Institute as now constituted is a thoroughly democratic institution with a well-balanced governing body representing all areas within the Dominion. It has grown to meet the vision of a speaker at the 1908 annual meeting who said that " the attention of the Society should be directed particularly to the building up of the local branches which should be practically provinces of a Dominion of engineers, and to making the annual meeting the most important technical event of the year ".

Provincial Professional Associations

Since the close of the First Great War there has grown up a provincial movement of great strength, a development that the older members of the Institute regarded with considerable apprehension in the 1890's. The movement commenced in British Columbia in 1920. It is perhaps a natural one, for that Province is far distant from the cities of eastern Canada, and is by nature particularly a home for engineers. The great natural features of the Province,—mountains, mines, fiords, rivers, glaciers, cannot be controlled without the assistance of men skilled in engineering science. There is probably no province in which the proportion of the number of practising engineers to the total population is greater. The local association there owes much to the energy and devotion of its secretary, Mr. E. G. Wheatley, M.E.I.C., who guided its growth from 1921 to 1937.

The incorporation of the Ontario Association followed in 1922 and there are now well established associations in every province except Prince Edward Island. The formation of the Dominion Council of Professional Engineers followed in 1936 as a very desirable step having regard to the unity of the profession. It is sincerely to be hoped that the associations will be as generous as possible in their recognition of the members of the other associations. It is very desirable that the rising generation of engineers should have opportunity to work in every section of the Dominion, there being no more valuable asset to the practising engineer than a knowledge of the peoples and of the natural characteristics of every part of Canada. The Provinces differ widely in natural formation, and in the problems they present to the engineer. In general these can be most effectively dealt with by the men who have grown up among them. On the other hand, the underlying principles of mathematics, physics and chemistry are the same everywhere, and it does not take over long for a competent man to master local conditions. A Canadian, as distinct from a provincial profession, is very desirable.

Other Institute Aims and Activities

The Institute has throughout the years of its life maintained a public position worthy of its membership. The memorials that it has laid before the Dominion Government from time to time have received courteous respect and consideration. A glance through its library catalogue will reveal to any member how far reaching are the contacts that it maintians with similar institutions in many parts of the world, and how much valued technical information it makes available to its members through such contacts.

At the Institute's gatherings, representatives of the great engineering societies of the world are frequent and greatly welcomed guests, testifying to the position that Canadian engineering has won for itself in the world of busy and wide-awake technical men. Invitations to the Institute to send representatives to special gatherings of engineers in other parts of the world are also a pleasing tribute to its standing.

Perhaps this address may most fittingly be brought to a close by a quotation from the presidential address of Mr. H. H. Vaughan in 1919, immediately after the ending of the First Great War. " Our Institute ", he said, " must be eternally proud of the achievements of its membership in this terrible war; 960 have enlisted, of whom 943 were officers before the war ended. Seventy-five have been killed or have died of wounds and 116 decorations have been gained. This constitutes a testimony to the loyalty and ability of the engineering profession to which it can point with honourable pride ".

At that date the membership roll contained fewer than 4,000 names, and the Institute may well be proud of the prompt service it has given to our country both in peace and in war whenever occasion has demanded. If the numbers of our members who served Canada between 1914 and 1918 directly or indirectly in the production of munitions were to be added to the number of those in active service the value of the services of the Institute to Canada would be seen to be second to none.

PLEASE COOPERATE

Elsewhere in the pages of this *Journal*, you will find a business reply card for your use in supplying information for the membership list which the *Journal* expects to print in the November issue. In order that the list may be as complete and exact as possible, please return the card with the required information

AS SOON AS POSSIBLE

N.B.—*Authorities contend that 70% response to these cards is very good. Will you not help us to prove that engineers are well above the average?*

IT'S YOUR MEMBERSHIP LIST
WHY NOT DO IT RIGHT NOW?

THE PRESENT ASPECTS OF ENGINEERING

LESSLIE R. THOMSON, M.B.E., M.E.I.C.
Special Liaison Officer, Department of Reconstruction and Supply, Ottawa.

Believing that the best commentary on today's situation in engineering is to recount the recent attainments, Mr. Thomson sketches industrial activity in Canada from its earliest beginnings in the fifteenth century down to the immediate prewar years. He then outlines the changeover to a wartime economy and explains the agencies set up for war production, such as the Department of Munitions and Supply and the various controls and Crown Companies. The importance of Canada's power resources are appraised in relation to industry. The transition from war to peace is dealt with and conclusions are drawn therefrom. In conclusion he comments on various phases of government service, and weighs the advantages and disadvantages of our democratic system of Government.

Engineering in its essence is the coordination and application of the three fundamental and ever expanding sciences of mathematics, physics, and chemistry. The desirable end results of constantly improved industrial production can only be obtained by the maintenance of vigorous research and improved techniques in industrial production, coupled with an ever growing alertness to the need for enlightened cooperation between the three fundamental factors in modern industry: management, capital and labour, with no intention to indicate by this order of statement the relative importance of these partners to industrial production. Only by establishing a reasonable balance between the contributions of these three respectively is it possible to create a good society.

An understanding insight into the modern techniques of mass production can perhaps best be obtained with an introductory note on the historical background of Canadian industry.

Historical Background of Industry and Manufacturing

The Canadian manufacturing industry had its origin in the local trades which sprang up, as in other "new" countries, based primarily on local demands and raw materials. Thus at Annapolis, Nova Scotia, the first water wheel to turn a mill on the North American continent (north of Mexico) was set up in 1605. In Upper Canada the first mill was built at Niagara Falls in 1786. The Napoleonic wars which set in a little later placed this Canadian pioneer milling industry on its feet by providing a foreign market. Lumbering began in the lower St. Lawrence and the Maritimes. The saw mill faced the grist mill on the streams which provided power for the early settlers of Quebec and Ontario.

Still earlier, masts and spars for the French navy were shipped from New Brunswick as early as in 1667. The historic squared timber and "waney" lumber trade centered in Quebec. Some time later, this developed into the great squared pine trade in Quebec City in the early and middle period of the 19th Century Frontenac recommended the smelting of iron at Three Rivers in 1672. Early in the nineteenth century, iron became the chief Canadian industry. As a result of these various and somewhat scattered efforts, other miscellaneous manufacturing gradually came into being.

In the main the industrial revolution was late in reaching Canada, and the total value of shop and factory products at Confederation in 1867 was probably under $200 millions. The typical factory was small and catered only to local markets. The end of this phase was written in the tariff legislation of 1878 which abandoned minor and incidental production and aimed to create a varied and rounded economy based on manufactured products, as well as raw products including agriculture. This constituted the so-called National Policy of Sir John A. Macdonald. Following its adoption there occurred a rapid expansion of industry, which doubled itself within about ten years. But the long continued fall in prices and the general depression of the late 1880's and early '90's soon succeeded in checking this forward movement, and it was not till the turn of the present century that the advance was resumed.

The rapid settlement of the Canadian West in the period 1900 to 1912 coincided with a no less rapid industrialization in the east. In that period the output and captalization of industry trebled, the number of employees doubled and an even larger proportional wages' increase took place. Throughout the whole period there was a strong tendency to concentration of industry, and this new integration of Canadian industrial plants was well started.

Perhaps the greatest single factor in the growth of Canadian industry was the effect of the Great War 1914-18. During that time the volume and value of output created by the pressure of war orders doubled, and the cessation of imports in many lines led to an extraordinary degree of diversification which has since been characteristic of Canadian industry. During that period the Shell Committee and the Imperial Munitions Board between them expended well over one thousand millions of dollars. Ths was exclusive of the shipbuilding industry, which involved an expenditure in the war years of almost $200 millions.

In the period between the Great War and the World War just concluded, the value of general manufacturing production followed the general Canadian economy in its upswings and downswings. The year 1929 estabilshed an industrial "peak", which was not again attained until World War II. But it is striking to note that compared with 1900, Canadian manufacturers showed in the first 30 years of the century a growth of 9 times in capital assets, almost double the number of employees, and almost 7 times the value of production.

Present Situation, 1937-1946

(a) peacetime economy

One of the important factors in the Canadian economy in the period before World War II was that agriculture and other primary production. To-day the more than half of the national income. In 1937 about 52 per cent of the national income was provided by agriculture and other primary production. To-day the situation is greatly different, even after the transition from war to peace will have been completely effected. In 1943 industrial production was about 61 per cent

Table 1

NET NATIONAL INCOME AT FACTOR COST AND GROSS NATIONAL PRODUCT AT MARKET PRICES. 1938-1946

(Millions of Dollars)

Item No.	1933 (Approx.)	1938	1939	1940	1941	1942	1943	1944	Revised Prelim. 1945	Prelim. 1946
1. Salaries, wages and supplementary labour income	....	2,449	2,540	2,860	3,529	4,233	4,790	4,969	4,865	5,112
2. Military pay and allowance	....	9	32	193	386	641	910	1,068	1.132	315
3. Investment income	....	692	782	1,110	1.518	1,765	1.809	1,785	1,916	1,776
4. Net income of individual enterprises, agriculture and other	....	790	867	949	1,081	1,638	1.560	1.863	1,674	2,009
5. NET NATIONAL INCOME AT FACTOR COST (1) + (2) + (3) + (4)	3,193	3,940	4,221	5,112	6,514	8,277	9.069	9,685	9,587	9,212
6. Indirect taxes less subsidies	....	646	743	843	1,062	1.092	1.125	1,125	1,006	1,237
7. Depreciation allowances and similar business costs	....	504	528	581	684	771	819	771	711	756
8. Residual error of estimate for reconciliation with Table 2, Item 7	....	—15	+3	+92	+75	+156	+111	+190	+174	—76
9. Gross National Product at Market Prices (5) + (6) + (7) + (8)	4,100	5,075	5,495	6,628	8,335	10,296	11.124	11.771	11,478	11,129

of the whole. This proportion still obtains, broadly speaking. Consequently the old concept of Canada being an agricultural country is no longer true. Today Canada's economy is predominantly industrial, with a high reliance on export trade. Indeed one of the striking features is that Canada's external trade determines in large measure the prosperity of our railways, in that car loadings and the general revenues of the railways, and indeed of some other forms of transport, vary almost directly with the levels of our export trade.

(b) WARTIME ECONOMY

The fundamental data of the Canadian economy in the period of 1937-1946 are set out in the following tabular digests, named Tables 1 and 2. As a matter of interest, figures on the national income for the depression year of 1933 are included to illustrate the extraordinary advances made in the Canadian economy in a period of only thirteen years.

The distribution of the war expenditures shown in Table 2 includes all those made by the Dominion government. It is seen that war expenditures in 1944 involved about 38½ per cent of the national budget. Table 3 shows, in terms of physical units, the distribution of those portions of the war expenditures made by and through the Department of Munitions and Supply.

It is important to realize that real income in the long run must be measured in goods and services. Therefore, the growth in the volume of manufacturing production, as distinguished from its value, must be one of indices of real national income. The important thing is whether consumers are getting more goods and services, not whether they are spending more dollars. Using such a volume index, we find that industrial production, based on the average production of 1935-39 being equal to 100, advanced in 1943 (and 1944 would be substantially the same) in accordance respectively with these figures: Textiles, 40 per cent; Iron and its products, 228 per cent; Non-ferrous metals, 155 per cent; and Chemicals, 294 per cent. It was a great accomplishment.

Now let us review and summarize briefly the whole Canadian manufacturing industry. The published data available indicate an extraordinary increase in the number of employees from 1939 to the peak of the war years in 1944. At the peak about 1.2 millions were gainfully employed, and of this number about 28

Table 2

GROSS NATIONAL EXPENDITURE AT MARKET PRICES, 1938-1946

(Millions of Dollars)

Item No.	1938	1939	1940	1941	1942	1943	1944	Revised Prelim. 1945	Prelim. 1946
1. Government expenditures—									
(a) War—goods and services, excluding Mutual Aid	37	75	583	1.209	2.330	3,114	3,336	1,816	735
—Mutual Aid, etc	....	....	....	....	1,002	516	961	1,041	200
(b) Non-War	682	703	661	665	683	697	764	850	1,000
2. Gross investment at home—									
(a) Plant and equipment	505	490	667	842	689	571	657	823	1,100
(b) Inventories—Wheat Board	88	94	5	—39	35	110	—7	—212	—33
—Other	—55	215	337	280	104	—267	—37	—166	308
3. Personal expenditures on consumers goods and services	3,700	3,799	4,293	4.956	5,511	5,896	6.268	6,824	7,383
*4. Add current receipts from abroad for goods and services, excluding Mutual Aid, etc	1,363	1,452	1,802	2,464	2.373	3,456	3,558	3,590	3,225
5. Deduct current expenditures abroad for goods and services	—1,261	—1,331	—1.627	—1,967	—2,275	—2.858	—3,539	—2.914	—2,865
6. Residual error of estimate for reconciliation with Table 1, Item 9	+16	—2	—93	—75	—156	—111	—190	—174	+76
7. GROSS NATIONAL EXPENDITURE AT MARKET PRICES (1) + (2) + (3) + (4) + (5) + (6)	5,075	5,495	6,628	8,335	10,296	11,124	11,771	11,478	11,129

*In addition to the exclusion of Mutual Aid minor adjustments have been made in the figures of Current Receipts shown in "The Canadian Balance of International Payments, 1926-1945", Dominion Bureau of Statistics, page 47.

TABLE 3

CANADIAN WAR PRODUCTION

	1940*	1941	1942	1943	1944	1945	Total
AIRCRAFT:							
Number accepted·							
Service planes	147	668	862	898	2,364	1,394	6,333
Advanced trainers	54	333	2,328	1,926	1,430	319	6,390
Elementary trainers	703	698	592	1,309	384	0	3,686
Totals	904	1,699	3,782	4,133	4,178	1,713	16,409
Total weight in pounds, without engines	1,740,000	4,358,000	17,578,000	20,088,000	27,892,000	......	71,656,000
VEHICLES:							
Mechanical transport	70,000	119,000	198,000	173,000	147,000	87,756	794,765
Trailers	......	......	1,599	1,626	6,327	5,098	14,650
Tires (total including military and civilian)	5,743,801	3,778,127	1,916,924	1,598,333	2,616,745	......	15,653,930
ARMORED VEHICLES:							
Tanks and self-propelled mounts	.....	100	2,044	1,926	1,737	783	6,590
Carriers and others—tracked	......	2,927	8,783	10,487	8,968	3,246	34,411
Wheeled vehicles	......	......	2,160	3,075	3,503	1,315	10,053
Totals	......	3,027	12,987	15,488	14,208	5,344	51,054
GUNS:							
Barrels and forgings	200	6,100	21,100	38.500	16,100	9,797	91,797
Carriages, mountings, etc	......	300	13,500	10,200	3,200	2,124	29,324
Including:							
4-inch naval guns (including barrels)	......	......	107	805	701	136	1,749
4-inch naval mountings	......	......	68	657	468	147	1,340
25-pounder equipment (standard and self propelled) (incl. barrels)	......	122	859	1,269	1,191	340	3,781
40 mm. Bofors equipment	......	5	1,528	1,880	869	70	4,352
40 mm. barrels and forgings	154	3,688	8,580	23,517	8,279	8,107	52,325
3.7-inch anti-aircraft equipment	......	......	452	1,114	169	......	1,735
3.7-inch anti-aircraft barrels	......	1,037	2,252	1,380	638	......	5,307
SMALL ARMS:	1,400	25,700	330,000	584,500	531,200	354,960	1,830,760
Including:							
Bren M. gun	1,391	15,977	45,095	74,663	32,537	17,139	186,802
Sten M. carbines	......	......	15,868	57,966	36,827	9,416	120,077
.303-inch rifles	......	6,847	193,655	331,038	273,364	96,228	901,132
20 mm. mountings	......	......	64	2,348	10,555	184	13,151
2-inch and 3-inch trench mortar and bomb thrower	......	550	17,521	27,665	22,519	5,405	73,660
Browning M. gun	......	1,863	31,937	23,980	......	......	57,780
Anti-tank rifles	......	......	20,365	30,246	......	......	50,611
Pistols, 9 mm	......	......	......	......	71,995	......	71,995
GUN AMMUNITION:							
Complete rounds, filled	......	1,200,000	28,000,000	30,000,000	30,000,000	22,375	89,222,375
Empty cartridges for export (†)	958,000	4,445,000	15,025,000	18,323,900	14,654,000	3,919	54,418,919
Empty shells for export (†)	......	3,000	1,356,750	887,400	558,300	1,171	2,806,612
SMALL ARMS AMMUNITION (millions of rounds)	......	385	1,175	1,490	1,180	406	4,636
CHEMICALS AND EXPLOSIVES (net output in short tons)	13,500	145,000	430,000	500,000	675,000	418,000	2,181,500
SHIPBUILDING:							
Cargo vessels—number	......	1	81	150	113	46	391
tonnage	......	10,350	838,350	1,478,000	1,066,000	396,000	3,788,700
Naval escort vessels	14	101	116	100	123	32	486
Other vessels and special purpose craft	2	22	35	655	2,168	660	3,542
CARGO VESSELS:							
10,000-tonners:							
North Sands	......	1	81	100	18	0	200
Victory	......	.....	......	33	48	0	81
Victory tankers	......	......	......	4	8	0	12
Victory stores issuing ships	......	......	......	......	8	4	12
Maintenance	......	......	......	......	......	15	15
Canadian	......	......	......	......	13	15	28
Totals	......	1	81	137	95	34	348
4,700-TONNERS:							
Grey type	......	......	......	13	14	0	27
Revised type	......	......	......	......	4	6	10
Dominion type	......	......	......	......	......	6	6
Total	......	......	......	13	18	12	43
Tonnage	......	10,350	838,350	1,478,000	1,066,000	......	3,392,700
NAVAL ESCORT VESSELS:							
Frigates	......	......	2	24	44	0	70
Corvettes (single screw)	14	54	15	21	18	0	122
Algerines	......	......	......	15	28	19	62
Fairmiles	......	16	43	18	11	0	88
Wooden minesweepers	......	.....	13	20	22	13	68
Bangor minesweepers	......	30	20	......	......	0	50
Diesel minesweepers	......	1	9	......	......	0	10
Western Isle minesweepers	......	......	14	2	......	0	16
Totals	14	101	116	100	123	32	486
OTHER VESSELS AND SPECIAL PURPOSE CRAFT	2	22	35	655	2,168	660	3,542

Total Production of Miscellaneons Vessels and Special Purpose Craft
(To December 31, 1945)

Motor torpedo boats	24
Ramped cargo lighters M.L.C.	1,662
Steel derrick scow, 25-ton	5
Railway barges	2
Base supply ships	2
Minca wooden barges	1,331
Tugs, steel, 60′	195
Tugs, diesel, 1,000 H.P.	8
Tugs, wooden 65′ and 80′	22
Tugs, 80′ steel derrick, diesel	16
Scow, wooden 90′	17
Auxiliary tankers, 168′	2
Scow, wooden derrick 25-ton	1
Wooden gate vessels, 100′	5
Transport and salvage vessels, 147′	2
Supply and salvage vessels, 114′	3
TOTAL	3,297 carried forward
Tugs, Modified Warrior	13
Tankers, 3,600-ton	6
Tenders, divers	5
Tenders, storing	26
Passenger craft, 75′	5
Nesting barges	190
Total carried forward	3,297
GRAND TOTAL	3,542

* Includes last four months of 1939.
† In addition, cartridge cases and other ammunition components have been produced and filled for export as components.
NOTE: Revised to May 15/46.

per cent were women. Having regard to the large numbers serving in the armed services in addition to these civilian employees in war production, one can appreciate the great strains on the whole Canadian economy. It was a period of high endeavour and consecration to a great task, and it is a striking comment that so many women gave so much to the common goal.

On April 9th, 1940, the Department of Munitions and Supply was brought into being under the powers of the Munitions and Supply Act passed in September 1939. The Honourable C. D. Howe, then Minister of Transport, was nominated as the responsible Minister in Cabinet for the Department's work, and Mr. G. K. Sheils was made Deputy Minister. Later, the Honourable Mr. Howe resigned as Minister of Transport and became the Minister of Munitions and Supply. By Order in Council and by Act of Parliament the War Supply Board and the Department of Munitions and Supply were made responsible respectively for two fundamental things. First was the centralization of all purchasing for the three armed services. As a result, most important economies were effected, and one can only hope that the lesson gained in the advantages of this system will be carried into the future. It is clear that most, if not all, of government purchasing could and should be centralized in one authority, and that the purchasing should be done under highly competitive conditions.

The second function of the War Supply Board and of the Department was briefly to promote, develop and control the Canadian productive economy. Through the work of the Wartime Industries Control Board, controls were established in steel, other metals, timber, chemicals, machine tools, aircraft production, coal, motor vehicles, rubber, power, oil, transport, ship repairs, and many other departments of the national economy. The powers given the controllers permitted them to divert strategic materials from non-essential into essential uses, and the result has been of profound benefit to the Canadian wartime economy. The Department gave wonderful service to Canada.

The contribution to industrial production for war made by engineers of all kinds proved to be extremely valuable. It is wholly impossible for one in my position to mention by name all the engineers whom I have known personally who gave of their best in one form or another to the common task. But I did have the privilege of working under and with many engineers of high attainments in fields of administrative skill and technical ability. In this connection I pay tribute to Rt. Hon. C. D. Howe, Mr. R. A. C. Henry, Dr. C. J. Mackenzie and many others in our Department.

Another factor of interest to engineers and business men in the development of the Canadian war effort was the establishment of crown companies to undertake specific tasks in the way of production. Examples of these are Research Enterprises Limited, Allied War Supplies, and many others. One of the reasons for using this form of organization was to avoid the serious delays always incident to Treasury Board regulations, and the other was that it became necessary to ask for the assistance in a quickly expanding economy of business men of high repute and ability. Such leaders are usually wholly unacquainted with government procedure. But, by using the form of an incorporated company, the Crown was able to give to such personnel a corporate organization with the administration of which business leaders were usually familiar.

As you all know industry is dependent on power—and so I will deal briefly with the water powers of Canada.

(c) RELATIONSHIP OF POWER TO INDUSTRY

The fresh water area of Canada is estimated at about 230,000 square miles, which is nearly twice as large as the whole land area of the British Isles. It is larger, also, than the fresh water area of any other country in the world. As many parts of this water area are situated at considerable heights above sea level, they become great sources of potential energy in the rapids and waterfalls of the rivers conveying the water from those areas to the sea. Consequently water power is today among the chief natural resources of Canada and its development in recent years has contributed materially in swelling the volume of Canadian manufacturing production.

A unique feature of water power is its inexhaustability. Its continuous use by industry in no way limits the ever recurring cycle of evaporation, condensation, precipitation and run-off by which the supply is always assured and always renewed. Another significant fact in the Canadian economy is that large reserves of water power occur in what is termed the acute fuel areas of Canada, where native coal is not available either physically or economically. The provinces of Ontario and Quebec without such native coal do include, however, great centres of manufacturing and population, and they also abound in many of the raw materials of industry. Within their boundaries these two provinces contain more than half the total available water power resources and more than three-quarters of the developed water power of Canada. Similarly in the Maritime provinces and in British Columbia, water power is in close proximity to large supplies of pulp wood. It also plays a large part in mining developments in British Columbia.

Out of a potential total of 24 hour power at 80 per cent efficiency, of 25.5 million hp. at ordinary minimum flow, or of 39.8 million hp. at 6 month flow, total turbine installation to date amounts to some 10.3 million hp. The water wheel installation throughout the Dominion averages 30 per cent greater than the corresponding maximum available power figures for developed sites at ordinary 6 month flow. Hence at present recorded water power resources of the Dominion will permit a turbine installation of almost 52 million hp.

The next point is that today Canada's total power development is second only to that of the U.S., and on a per capita basis in 1938 of 0.745 hp. is exceeded only by that of Norway and Newfoundland with 1.04 hp. and 0.87 hp. per capita, respectively. Switzerland and Sweden follow next after Canada. The United States has developed horse power on a basis of 0.14 hp. per capita.

Perhaps the next point to observe is the increase of power per wage earner. From 3.06 hp. per worker in 1917, it advanced to 9.46 in 1939—more than 200 per cent. The decline in the ratio in 1943 to 6.12 hp. is merely a measure of the large increase in the number of employees. But in effect the figures mean that today every wage-earner has at his disposal from 60 to 100 "slaves", using the usual ratio of about 10 men per hp. But these "slaves", unlike those tragic figures of previous times, are slaves who never tire and who never grow weary in well doing. It is one of the better accomplishments of a modern industrial society. Indeed, similar remarks can be made also of the service of mechanical energy and machinery to the whole Canadian economy. Every man, woman and child in Canada now enjoys the service of about ten of such tireless slaves.

We all agree that our present civilization is wholly dependent upon the utilization of mechanical energy. If the supply of mechanical energy should fail, the North American population of about 150 millions north of Mexico, would, in a short time, be reduced by famine and pestilence to a population that could be supported only by simple agricultural and pastoral pursuits. Our large cities would disappear completely, and hence you realize that this present society is dependent completely on the wisest utilization of mechanical energy.

Cheap power in assured quantities is perhaps the greatest single magnet in attracting industries of many sorts to Canada. When, as is true in certain parts of Canada, such cheap power is found in proximity to a reasonably assured supply of competent labour, the lure is doubly powerful.

(d) TRANSITION ECONOMY

With the close of the fighting in Europe in May 1945, and in Japan in September 1945, the Canadian economy naturally began to feel the strains usually incident to a transition from war to peace, as for example disturbed conditions in the industrial fields. Considerable agitation arose for the lifting of government controls and for the return to a "free" economy. It is reasonably obvious that if the demands for the removal of controls had been met, many advances in price levels would have occurred. The government took, and I believe wisely, a reasonably middle course in regard to many of these conflicting pressures. Controls on gasoline and certain other commodities were lifted, but controls were maintained on many other fundamental factors related to the cost of living—timber, fuel, rentals, and so on.

Too hasty action in removing controls would probably have precipitated considerable advances in price levels and would have permitted certain large companies to take advantage of the resulting price situation to exact or demand all that the traffic would bear in the way of profits. On the other hand, other large companies would have been more conservative and realized their real obligation to the public. Similarly, many of the unions have been making spectacular demands for higher wages without at the same time undertaking to increase production. Money is not wealth. Wealth is production of goods and services, and it is only by an ever growing volume of goods and services that real wealth can be produced.

(e) CERTAIN RELATIONSHIPS BETWEEN CANADIAN AND UNITED STATES ECONOMIES

The general Canadian economy is in a peculiar position, in that Canada purchases in large volume from the United States, but is unable to sell to the United States in corresponding volume. Consequently, its external trade position must be reinforced by sale of goods and services to Britain and other European countries. But this can only be done if in turn the currency units of Britain and the said European countries are redeemable in U.S. dollars. Broadly speaking, Canada's normal external trade provides about thirty to forty per cent of the total national income and expenditure, and any drop in that relationship has a direct effect on the standard of living in the Dominion.

The external trade of the United States, on the other hand, represents less than 10 per cent of its total trade. Hence the United States is not dependent in any comparable way on its external trade. Among the citizens of the United States there is not a sufficient realization that international trade can only be maintained by a willingness to import from those countries who in turn are eager to buy from the United States. In this connection the recent agreements to establish the International Bank of Reconstruction and Development and the International Monetary Fund are examples of a growing awareness on the part of the United States (and indeed of the world) to accept the necessary concomitants of international world trade and world organizations. At the present moment there is being held in Geneva such an international trade conference, at which most of the great countries in the world are represented.

Turning again specifically to the interlocking of the Canadian and United States economies, the broad picture is that Canada is at the moment buying more from, than it is selling to, the United States. There is a limit to this one-sided trade. It will result either in the depression of the Canadian dollar, or an inability to continue to buy from the United States. Our U.S. dollar position, is, it is true, fortified by the export of gold and one or two other major exports as, for example, pulp and paper. But even then the future balance is not complete.

I would like to sound a note of warning as to the future. If all controls are removed, price ceilings are abolished, and other national services are done away with it is not improbable that we shall be in for an era of increasing and not unjustified demands on the part of labour for higher wages, having regard to the advances in prices which will inevitably take place unless both corporation officers and union leaders can come to an agreement, or to a common understanding, that high prices and large profits cannot go hand in hand with certain fixed wage scales. And so both to management and to union leaders, Mazzini's magnificent appeal is still true: "Fellow Citizens, I speak to you not only of your rights but of your duties."

Personal Observations on Government Service

I had the privilege of joining the service of the Canadian government in December 1939. For almost seven years I have been close to government and have watched its operations with a considerable amount of care and interest. Indeed for some time near the end of the first World War (1914-1918) I also had the privilege of serving government, as secretary for a short time of the National Research Council, and later of the Lignite Utilization Board. As a result of these contacts with government during two wars, I reached some tentative conclusions on government itself.

Perhaps the first of these observations is that I believe that the period into which we are now entering needs a different type of mind and background if government is to proceed on informed and sound lines. From the middle ages until the present, we have turned in considerable measure to lawyers as our representatives in Parliament, both in the House of Commons and in the Senate. In addition, there have been a number of business men of distinction. But in the main we have leaned on lawyers. In the past this was understandable, when lawyers were one of the few educated sections of the community. They had wide and sound training in human values, the balancing of human needs, and the weighing and desirability of compromise.

The future is a period in which science is going to play an ever increasing role, and it seems to me almost essential that we should choose many of our elected and senatorial representatives from those educated sections of the community which can understand the language of science. Too often in the past the attitude of the lawyer or the business man has been to hire the scientifically trained person and use him as a technician. While doing this however, the employer has little or no conception of the language nor the concepts and theories upon which the future world is to be expanded and established. Consequently, I strongly urge parliamentary representatives be increasingly composed of men drawn from the fields of science and engineering. They will understand the language of mathematics, physics and chemistry and therefore in any discussion of proposed policies related to government they can weigh intelligently the import and meaning thereof.

Incidentally, the custom, inherited from the early middle ages, has been to place upon occasion, military uniforms and swords on the leaders of state. Would it not be better for the future to dress our sovereigns and our political leaders in the garments of future realities? For example, dress them in appropriate civilian attire, and instead of a sword give them a test tube rampant or a slide rule couchant. These are the symbols of modern education. It must never be forgotten that swords coming down from the middle ages were the hallmark or accoutrement of those who despised learning, and the time has come for a change.

Perhaps the next conclusion can be summarized briefly by stating that any true democracy must involve compromises. On the one hand you have the idealists who wish to have government absolutely pure and unalloyed without any "low" endeavour. Such government would have to be composed, both in its policies and administration, of persons of the highest rectitude and integrity. No compromises would be permissible or possible. If something is right both as to principle and fact, then it must be done.

On the other hand, you have the more disturbing demands on the people's representatives. Constituents will ask for special favours for friends. They will want so and so let off from compulsory military service. They will want some special concession for their company. They may suggest that Mr. X be given freedom to seek campaign fund contributions and the like in the hope of getting contracts and so on. This is the more depressing aspect of government. It must be remembered always that government is a reflection of ourselves. And, in my opinion, we get a better government than we deserve. The whole of Canadian society, or indeed the whole of any society, is neither wholly fine, pure and splendid, nor wholly venal. Governments, in the long run, are as we make them. They embody our greatnesses and our weaknesses.

After several years of association with government I have reached one or two broad conclusions. Perhaps the first is that I personally do not yet know of any better system than our democratic system. If each citizen will to the best of his ability choose the candidate he thinks will best represent him, then we shall or should have a government "of the people, by the people, and for the people." But, as I said before, all government is a compromise, and certainly this must be true of any democratic government. Our present Canadian democracy finally produces a free and a responsible government; and, with all its necessary compromises, I am convinced that this free government is better than any allegedly "good" or mechanically perfect government.

ENGINEERING A WORLD THAT WORKS

H. BIRCHARD TAYLOR, M.E.,
Philadelphia, Pa.

The author is an engineer and an industrialist whose imagination and daring have made great contributions to the attainments of industry in the United States. He has maintained an interest in many things outside the technical field, and has given generously of his time and means to education, art and philanthropy. His broad experience and outlook fit him to appraise the future and to point out to the engineer his responsibility towards it.

Mr. Taylor shows that the arch enemy of freedom is not some foreign country with an alien philosophy, but is the materialism of today. Deluded by the false promises of materialism, we are confronted with spiritual problems for which we are unprepared. He sounds a ringing challenge to the profession. He seeks to jar engineers from their preoccupation with their material achievements, urging them to apply their scientific thinking to human relationships, so they may render a higher service to humanity in the field of social problems.

It is indeed an intriguing experience for me to be the guest of the Institute on the notable occasion of its Diamond Jubilee. I am in a great country. I have visited it many times and sufficiently, I believe, to get the real feel of it, but not to satisfy a longing to know it more intimately. There is so much to see beyond the railroads, hotels, office buildings and shops! One is deeply grateful for the encouraging prospect of our two countries building an even closer bond of friendship in the future.

What I shall say here, on the sixtieth birthday celebration of the oldest engineering institute in Canada will recognize the fact that the Institute has always remained dynamic and forward looking through the constant influx of younger members who have given it a virile character. It is interested in the past because vivid recollections of men and their works gives an appreciation of the living present and sound visions of the future.

To the younger members, possessing an abundance of imagination and infectious enthusiasm and with their lives before them, may it be said that wisdom never exists without the knowledge and experience which the older can supply. So to the younger, I should say, strive to acquire knowledge, experience, wisdom and especially the quality of persistence, which talent, genius and education cannot replace; and to the older, by no means allow your imagination to wane, for great events are always in the making and enlightened imagination can shape your destiny.

Thus it is to this balanced team of the younger, the older, and the departed members that, throughout Canada and reaching over the border into the United States, there looms large the dynamic, constructive spirit of the Institute in all branches of engineering. For this great contribution you should feel a justifiable sense of pride.

Individual Freedom and Responsibility

Individual freedom is one of our greatest treasures. It must be scrupulously safeguarded by our minds, hearts and prayers, strongly supported by our faith, words and deeds. Individual freedom without individual responsibility is wide open to powerfully organized forces of materialism, either from the extreme right or the extreme left, which are out to seal its doom. It required a very long time, with tough going, to secure the freedom and opportunities we now enjoy. In a democracy we cannot rest on our laurels. With the spirit of cooperation, abiding faith, and voluntary dynamic action, we must demonstrate a responsibility in which we all must share.

I know it is just as provoking to you as it is to me, to witness large numbers of people so completely engrossed in their pursuit of "business as usual" that they will not lend an ear, let alone a hand, to the building of safeguards against influences which may wipe out their "business as usual".

Justice, freedom and respect for the law cannot be living realities unless public opinion and public action give them life, and protect that life. Under good government there is justice for all; there is freedom—but not the freedom to undermine, corrupt, or destroy; there is free speech—but not the licence to manufacture evidence, nor to preach destruction of government by force or slow disintegration; and laws under which all citizens stand equal. The character of a government reflects that of the governed. Good government requires of all citizens that they be responsible.

I feel that this Diamond Jubilee Meeting offers a unique opportunity and a most appropriate occasion to think of matters far more important than the technicalities of our profession — namely the broadening of the spheres of thinking and action of the engineer so that he may carry into other fields, the much needed factual thinking which motivates his actions in material engineering.

Broad experiences in later years, in many branches of human endeavour, have made it crystal clear to me, that it is precisely this character of thinking we so badly need in economic research; in the great field of labour-management relations; in the complicated fields of human affairs, where we all must discharge our proper social responsibilities; and in our efforts to build an enlightened public opinion capable of anticipating, understanding, and solving the difficult problems of our times.

A New Field of Service for Engineers

I want to make clear how much I appreciate my fellow engineers and how highly I value the services our profession has rendered society. In what follows I would like to think of engineers as citizens of a free country, and of the great contribution we can make toward the preservation of our freedom. For with all our advance in technological skills, we have nevertheless witnessed certain serious breakdowns in our democratic way of living.

We have seen the actions of pressure groups proceeding with little or no concern as to effects of their pressures on the overall economy. We have seen government strongly influenced by political expediency. We have seen the damage on national scales resulting from selfishness, hatreds and delusions as to racial or class superiority and we have witnessed large sections of humanity struggling with problems so difficult to them as to make their solutions beyond their unaided ability.

We have seen attempts to solve problems by a rearrangement of the existing order, when it should be evident that the problems arise irrespective of the type of order, old or new. The simple fact is that we have failed to go to the root of the problem, by not dealing with human nature itself on a worldwide scale. We need above all other considerations a new spirit in human nature.

Materialism the Enemy of Freedom

I am convinced that the arch enemy of freedom is not some foreign country with an alien philosophy, but something that dwells in you and me and in all men. That something is the glorification of position, privilege, prestige, possessions and power for their own sake. It is selfishness and greed, and it breeds jealousy and hate and conflict. It is called Materialism.

Because of the grip of materialism, this generation goes into the future with a tremendous burden of bitterness, hate and confusion. The miracles of material achievement to which engineers have contributed have not lessened this burden; on the contrary, by raising the stakes of the game of grab they have stimulated envy and greed. In a world dominated by materialism atomic bombs cannot fail to go off. I believe that materialism is undermining the very foundation of freedom by turning men and women away from moral standards and belief in God.

People are the building material of a social state. In contrast to wood or steel, there is no quantitive unit in terms of which the social strength of people can be measured or expressed. But we have a name for it—we call it "character". Character is expressed as honesty, fairness, unselfishness, consideration for others and devotion to moral and spiritual values. Where character is lacking, we find all the elements of social disintegration, war profiteering, black markets, broken homes, contempt for the law and for the makers of the law. Three sneers for everything and three cheers for nothing.

No social structure, however cleverly conceived or perfectly designed, can withstand the unprecedented social strains brought about by the material miracles of technology unless its social building material is tough and strong. You cannot build an 85 storey skyscraper out of mud bricks, nor can you build a free world that will withstand the strains of an atom-split era out of 'me-first' citizens. Me-firsts drift either to the right or to the left in a desperate effort to cling to position, privilege, prestige and power, more dear to them than freedom, service and moral values.

Anything the mind of man can conceive or the hand of man can fashion can be used for good or ill. The choice is always moral. We can use atomic energy for the service or destruction of mankind if we choose. An international police force can be used to preserve freedom or enslave the entire world There is no security among men or nations apart from the determination to make moral rather than immoral choices. No form of protection can equal the good will of one's neighbors.

Here then is our dilemma: on the one hand, technological progress is forging instruments of vast potentiality for good or evil, at ever-increasing speed; on the other hand, deluded by the false promises of materialism, we have lost our faith in God and with it the toughness of our moral fibre. While the weight of our social structure grows and grows, due to specialization and the inescapable law of interdependence, the bricks which support it become weaker and weaker. How strange that the creative handiwork of engineers has turned out to be a mixed blessing, by confronting us all with spiritual problems for which we are unprepared and seemingly unequal.

Need Better Citizens Born of Changed People

Our social structure needs better bricks, better citizens. To produce these we must change and be different.

I am aware that many think human nature cannot change. Although this view is understandable, I do not accept it. The best refutation I know was given by a British Cabinet Minister, Lord Eustace Percy, who said, "To expect a change in human nature may be an act of faith, but to expect a change in human society without a change in human nature is an act of lunacy."

Modern skepticism refuses to come to grips with the root cause of our trouble, which lies within ourselves. It wastes immeasurable effort in a vain struggle to win security through the treatment of symptoms and effects. Suppose a typhoid epidemic breaks out in a city. Would the medical officer rely solely on more nurses, doctors and ambulances; or would he test the water and milk and sanitation, find the cause and eliminate it? Unless the cause is removed, the epidemic is bound to get out of control. How then can we cope with deadly world sickness if we shirk the task of dealing effectively with its human cause?

Moral and Spiritual Counterpart of Material Change

Even engineers forget the hard fight that science had to win recognition. Only a few centuries ago we knew nothing of natural laws; apples fell but the general law of gravity was unknown. Knowledge consisted of an awareness of a vast hodgepodge of seemingly unrelated phenomena. People scorned the possibility of novel inventions that had no precedent in their own experience. But when at last minds opened, searched for truth, tested, verified, believed and ventured on the strength of their faith, mighty forces were released and a fantastic material revolution followed.

I believe there is a moral and spiritual counterpart to this; that the fulfillment of these same conditions opens a door to the discovery of moral and spiritual truth. We shall have no peace until we have restored to society its moral core. How many of us engineers are willing to accept full responsibility for the social consequences of our own handiwork, and brave enough to tackle the job of moral restitution? How many of us see that the job starts not in somebody else, but in ourselves, and how many envisage the outreach of a change in ourselves on society at large.

The Law of Interdependence

There is a lesson in interdependence which I learned from hydraulic turbines which I should like to bring to your attention.

In 1922 the Niagara Falls Power Company contracted for three 70,000 horsepower turbines, at that·

time the highest powered prime movers in the world. Two complete turbines were awarded to the I. P. Morris Company of Philadelphia and one to the Allis-Chalmers Company in Milwaukee. A spare runner or rotating element was ordered from the latter company with the understanding that it would be suitable for operation in the turbines of either manufacturer. The two manufacturers were required to agree upon over-all dimensions which would make possible this interchangeability of runners. Aside from these restrictions each manufacturer was perfectly free to design in such a way as to give its turbine the benefit of the latest ideas gained out of its own experience. So the design of the vanes of the Allis-Chalmers runners were not related to the guide vanes of the I. P. Morris turbines. This was not deemed necessary. How little we knew!

Both manufacturers achieved exactly the same peak efficiency, namely 93.8 per cent. This was a world's record not surpassed for twenty years. However, the significant thing to me was that when the Allis-Chalmers runner was installed in the I. P. Morris turbine, the over-all efficiency of the unit dropped considerably. The performance of a turbine is the over-all result of the interdependent effect of all its contributing hydraulic elements. A change in the design of one will affect, in some degree, the contributions of the others. Until this inter-relation was fully appreciated, we were working with methods fraught with danger. This law of interdependence can be applied to any effort, in any field, where the performance is the over-all result of the interdependent effects of two or more contributing elements.

The law of interdependence is just as vital in the relation of the engineer to the world of human behaviour. The engineer is too prone to detach himself from responsibility for what goes on in society around him. The relation between predictable aspects of the physical world and the apparently less predictable aspects of human behaviour is one to which the engineer must now address himself. The endurance of the achievements of the engineer even in his own field is entirely dependent on the human element that constitutes our society. We have just witnessed the destruction of billions of dollars worth of brilliant engineering achievement in many parts of the world. The work was perfect. What went wrong? Human nature went on the rampage. A prime element was out of control.

How, then, can the engineer take his share of responsibility for the society in which he is embedded? I am reminded of the boy at college. He did not do very well on his mid-year exams. So he telegraphed his brother at home. "Flunked four out of five exams. Prepare father." Just as he was boarding the train for home a telegram was handed to him signed "Brother". It read, "Father prepared. Prepare yourself."

Moral Re-Armament the One Hope of the World

The clue to this responsibility I have found in recent years through a group of people both in Canada and the United States—part of a rapidly growing world force known as Moral Re-Armament. My first real contact with this group was at a great defense rally in Philadelphia two days before Pearl Harbor. I spent two hours talking with the Moral Re-Armament people. They knew things going on in the world that I didn't know anything about. If what they said were true, then it required an entirely different approach to the future from any I had ever had. Moreover they practised what they preached. As time went on I discovered that they not only thoroughly understood the problems which had to be faced, but the techniques and methods of effectively meeting them as well. I couldn't see how any person who had regard for his country could be indifferent to, or escape from, what these people presented. For what they presented was live evidence of a working answer to our most pressing problems.

Later I invited the president of our shipyard workers' union to go along with a considerable party of labour and management to a Moral Re-Armament industrial conference at Mackinac. On the way, I began to get to know the president whom I had hardly known up to that point. He had been cautioned by his union not to say anything. He had a speech prepared in case he had to talk. I gave a speech at Mackinac which this president said was so different from what he had anticipated from me, that he tore up his own speech and spoke extemporaneously.

It was the beginning of understanding and labour-management teamwork between us. We built understanding, trust and confidence, which gave us a common objective—namely, to do a maximum job of teamwork in the war effort. The result was something of a surprise. It brought into the open forces who opposed such teamwork from both sides. In some management circles I was labelled as having a dangerously "soft" attitude toward labour. On the other hand I was attacked in the New York *Daily Worker* as "Labour-hater Taylor".

There are very active forces in the world opposed to the principles of teamwork. Either through ignorance, blindness, or through wilful intent, they seek to break down teamwork and promote a philosophy of conflict and class warfare. By creating confusion, conflict and breakdown, these forces hope to gain control. We have a tremendous ideological struggle throughout our society. The ideology of teamwork must have a dynamic incentive if it is to win out. The battleline runs through every heart, every home, every industry. In industry the true battleline is not between management and labour where some would draw it, but between the sound and unsound elements in both.

No one can side-step this struggle. It is a struggle of vast proportions on a world-front. Actually, we are already in World War III. It is a war of ideas. But if we win the battle for teamwork, we gain a victory in which no one loses. If we lose that battle, all lose—and most of us will lose all. Not to participate in that struggle *now* is only to participate in disaster *later*.

As I became aware of these fundamental truths, I saw clearly the stark fact that without restoring moral and spiritual values as the governing element in the lives of men and women, democracy would drift inevitably toward world-wide conflict and eventually to totalitarian slavery. I then reached a conviction, that moral re-armament was right and is right—that without the dynamic of the Christian ethic in the hearts of its leaders, democracy would lose its vital spark and eventually perish.

As I have paid tribute to engineers who have set us forward on the road of material progress, so now I pay tribute to the pioneering spirit and the dare of Frank Buchman, the initiator of this world-wide movement, whom I consider one of the greatest statesmen of all time.

Do not mistake me. I am not suggesting that because material achievements carry the danger of abuse and perverted use we cease our efforts to improve our standards of health, comfort, education and culture. Yet I do long to have engineers recognize that their preoccupation with material achievement has narrowed their viewpoint, and results in something akin to social immaturity. The honest, factual, clear-headed thinking which is characteristic of our profession is greatly needed in place of much that is wishful, partisan, irresponsible and selfish. I know of no group better fitted to furnish this missing element than engineers. But we must broaden our sphere of thought and action far beyond material engineering. We must include human engineering so that the application of the scientific method may render an immeasurably higher service to humanity in the field of social problems. Some look upon participation in this task as involving sacrifice, and in a sense this may be true. I prefer to think of it as investment in a field which preserves and gives value to all those things we treasure most dearly.

In 1942 many refused to believe that a war of ideas between the Christian ethic on the one hand and a purely materialistic idea on the other was taking shape throughout the world. Few indeed would deny it today. We have only to look at our daily newspapers. Even so there are millions who seem to believe that there is no occasion to be disturbed, that the pendulum has swung rather far but in due course if we just keep our shirts on, it will swing back. Such thinking is dangerous. Unless we bestir ourselves and get into the fight, the freedom we have known and loved will disappear.

I encounter others who see the war of ideas more or less clearly but decline to have any part in it. The industrialist who establishes good relations in his own plant may think he is secure. But is he really secure if industry as a whole is in danger? If conflict flares up throughout his industry he is bound to be affected in the end. His only safeguard is to enlist with others in a concerted fight to establish teamwork, confidence and trust throughout industry as a whole and thus insure against the collapse of his own enterprise through forces entirely beyond his own reach.

Even today, some say, " Yes, I know it is serious, but what can I do? What can any man do? The forces arrayed against each other are gigantic. I could not influence the outcome in the slightest." This is sheer defeatism. It is escapism, too. It is the voice of a man so pre-occupied with secondary activity or so wedded to his personal comfort that he has lost the love of battle. Any one of the engineers who harnessed Niagara would have said, " I cannot do it alone. The job is too big for me." But together they tackled the job and it was done! Engineers have always said: " If it is worth doing, it can be done—and we can find a way." Where are the men who will take up this social challenge?

I believe we can win the war of ideas. I believe we can make the inspired faith of democracy triumph over the false doctrine of materialism, but we cannot do it by sitting in our arm chairs by the fire. We can only do it by getting into the dust and grime of a battle for the heart of our country.

Good works are better than none, but they are not good enough. We have gone far beyond the stage by which good works can save our sinking civilization. It is as necessary for us to deal with the cause of our malady as it is to get rid of the cause of a typhoid epidemic. We need change, revolutionary change. To win we must unite and fight. Approval and appreciation are gratifying, but we need men and women who will get into the boat and pull an oar.

It does not need a majority to do the job. A small determined minority can give an inspired lead to democracy that will insure our freedom, and with it the fruits of material productivity in abundance beyond our wildest dreams. But we must act before it is too late. The situation is critical now. We cannot have freedom on our own terms. The terms are embedded in the laws established by their Creator. We have tried to have our cake and eat it too. We wanted our liberty without the responsibility that gives it life and virility. We cannot have it. Liberty without responsibility is an impossible idea. As the revered founder of my city, William Penn, said, " Men may choose to be governed by God, or they condemn themselves to be ruled by tyrants ".

We have travelled far on the wrong road. Catastrophe yawns at its end. The road back is not easy. But it is the only road to the things we hold most dear—to freedom, to security, to friendships among men and nations. To travel that road we must learn to give and not to grab; to love and not to hate; to work together in harmony as a team; to return once more to the God Who made us. Here is a task worthy of the greatest. Here there is a place for every man, a place that will satisfy the hunger for great living that lies deep down in all of us. Here is the biggest engineering job of all time. The job of engineering a world that works.

THE CHALLENGE OF WORLD LEADERSHIP*

J. RUSSELL WIGGINS
Managing Editor, "The Washington Post"

It is not my purpose to discuss current public figures or current legislation. Anything that I may say which remotely relates to particular persons or bills is purely coincidental. I have come here with a grim determination to be cheerful in an otherwise gloomy world. I wish to talk about an extraordinary post-war mood that has gripped this country producing neuroses of anxiety, apprehension, fear, uncertainty, insecurity, doubt and disillusionment.

It is not altogether surprising that such feeling should arise at this time. A "let-down" feeling is to be expected after any great military effort such as the one we have just survived. The tasks of peacemaking have been exceedingly difficult and progress toward the final peace treaties has been disappointingly slow. The burdens of victory, we have discovered, are very great. Whatever our wishes or inclinations, we find ourselves charged with the awful responsibility of world leadership. The estrangement from late allies, partly a characteristic of alliances and partly a product of the policies of Soviet Russia in particular, has aroused fears and anxieties. The development of atomic energy has created apprehension as to our ability to use this tremendous power in constructive ways without risking the destruction of civilization itself. Recollections of past cycles in our economic life, associated with a widely pervading notion that history repeats itself with the monotony of idiocy, have caused great disquiet as to the country's economic future. The disputes of labor and management have disturbed the public mind and upset our faith in our own abilities to work out the problem of dividing the fruits of our productive enterprise.

Surely, it is not necessary to extend this catalog of our worries to make it clear that we labor among difficulties that counsel any reasonable citizen to take a sober view of the world. No sane person could avoid serious thought as to future developments in such an environment.

Still, I think we need to give some thought to circumstances that somewhat redeem the invariable gloom. It is true that the peace of the victor is not altogether pleasant; but it is not as hard a peace as the peace of the vanquished. If we sometimes seem to be puzzled about what to do with our victory, I daresay it would confuse and distress us a great deal more to know what to do had defeat been our lot.

We are appropriately worried about atomic energy. Any people, burdened with a sense of responsibility to civilization, would be worried about the acquisition of such awful power. Still, we need not be as worried about it as we would have to be if some other power had been, from the beginning, the custodian of this terrible resource.

Thought about our economic future surely is counseled, in view of the past; but it is rather extraordinary that we should find the greatest economic worry in the one country in the world that emerged from the war with its economic facilities utterly unimpaired. It is strange to find together, in one land, the greatest productive resources possessed by any people now or at any time in the world's history, and the greatest worry about ability to produce in abundance. Peoples of many lands where there are left only the remnants of great industry must be somewhat puzzled by our economic fears. Perhaps only those with no fear of present want can afford to indulge in worry about future need. It is a luxury which at the moment, like many other luxuries, is virtually limited to America.

There is good reason to think as seriously about problems of government as Americans now are doing. We need to give these problems more and not less thought. Still, the worry and anxiety that color much of our political thinking and action must puzzle the people in other countries. Many of them no doubt envy us as a political system, a structure of government, and a social organization that is solid, enduring, well established, and unimpaired by war. Our governmental problems may be perplexing, but they hardly compare with the governmental problems of peoples who have had to improvise out of chaos new governments to deal with crushing emergencies.

Our timidity, nervousness, and anxiety, are not in rational relationship to the country's situation. In the midst of record-breaking agricultural and industrial production, we hear more about the possibility of economic collapse than we heard either before, during or immediately after the last great economic crisis. Astounding successes of wartime production, strangely enough, did not seem to inspire in us any real enthusiasm for, or confidence in, our system of industrial enterprise, our general economic system or our financial organization. That this system turned out more goods of more kinds for more purposes and for more people did not seem to impress us at all. We expected it to do better than any system that ever has existed on the planet; and with a queer sort of fatalism we seem equally certain that the whole vast organization is going to be disrupted by collapse. We sit, surrounded by the evidences of industrial health, preoccupied with morbid reflection on the inevitability of imminent affliction. There does not seem to be any basic flaw in our whole productive plant. No one alleges any physical reason why it should not continue to produce in abundance. There is no tangible circumstance that could explain why it should not yield to us and the world a higher standard of living than ever has been enjoyed on the planet. Yet, there is what amounts to a moral certainty that we are going to be overtaken by some psychological aberration that will render us impotent to man this planet and powerless to consume the goods it might produce. There may be a depression; but if there is, it will not be due to unavoidable circumstances but to some incredible paralysis of the will and the intellect that renders us unable to utilize the instruments at hand to deal with economic changes.

The tasks of world leadership that confront us are undeniably great. They are tasks that will endure throughout our history. There is no eluding them. The United States has become the first ranking power of the world, by no design, inclination or will of its people, but by the accident of history. It has been thrust into this position far in advance of the preparation of its people for such a role. Yet, the country is not unequal, in economic resource or political ingenu-

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ity, to the responsibilities that have been thrust upon it. The task of world leadership is not beyond the capabilities of the United States if its people have the will to perform the task. Perhaps it is the lingering timidity, the understandable anxiety, the strange uncertainty of adolescence that accounts for American behaviour. Mature in every outward aspect of world power, there still exists in the mind of America the adolescent inclination to run away from it all, to flee from the responsibilities of maturity, to retreat to the irresponsibility of long summer vacations and happy ignorance of the duties that make life burdensome for adults. Perhaps this explains, if anything can explain, the outlook of the country.

If this is a correct explanation, we can expect the country to outgrow this transient mental upset and settle steadily into a role of mature world leadership. Let us hope this will be the case. Dark as world prospects are they do not justify a psychology of despair. There is no task before us that can not be solved with the warm sweat of exertion better than it can be solved with the cold sweat of apprehension. Our world responsibilities are challenging but not necessarily crushing. What situations we can not submit to with grace we can subdue with gumption.

The mood of fatalistic pessimism is not appropriate to our present world role. The world is in great chaos to be sure, but the difference between the chaos of disintegration and the chaos of creation is to be found in the will and the intelligence of those who confront the chaos. The confused state of the world is the natural consequence of the dislocations caused by the most destructive of all wars. It is disturbing to orderly persons and societies to search in vain for a pattern; but it need not be the occasion for utter despondency. Periods of history in which patterns, in retrospect, can be plainly seen have confounded contemporary society by their disorder. We may be in the midst of an emerging pattern for a new world without being able to discern it in our own time. That pattern, moreover, is not utterly in the hands of a destiny uninfluenced by human thought and action. Man may be largely the creature of events; but events are partly of his creation too. It is hardly necessary to say that the jitters do not stimulate creative effort.

The creative exertions required of this country are not to be awaited in our leaders alone. The enlightenment of the people in a democracy sets the outside limits on the achievements within reach of leadership as surely as heredity governs longevity. American responsibilities are those of all the people and do not rest alone on the Americans lifted to high office by the accidents of politics. An American people with a better understanding of the strength of its own institutions and the abundance of its own resources can put into the hands of its leaders the instruments of political power that the times require. An American people, fearful, dismayed, anxious and apprehensive can only handicap the greatest leadership. It is not, of course, the cheerfulness of Pollyanna that we require, but the informed cheerfulness of a people aware of its responsibilities and willing to undertake them. It would be folly to suppose that there are no dangers ahead that justify some reasonable fears. It is also foolish to scare ourselves to death by listening to every alarmist who, like the Fat Boy in Dickens, "wants ter make your flesh creep."

People who are morbidly over-concerned about constant crises are prey to many disabilities. Their doubts and uncertainties make leadership indecisive and irresolute. They are also ripe for demagoguery. When they conceive things to be so bad that they are beyond human solution, they are ready to expect miracles. The present situation in the world is more likely to be remedied by muscle than to be relieved by a miracle.

A frightened people is also likely to make scapegoats of minorities in the search for an object for the hatreds arising from disappointment and frustration.

A fearful people is liable to other kinds of schismatic disintegration. The operations of dissident groups take on disproportionate importance in their eyes and inspire hysterical defence exertions that might be spent better in affirmative effort. The Nazis found how useful such exertions are in devitalizing the social cement that keeps complicated diverse societies tied together. They made even Anti-Nazism serve in this warfare of internal disintegration.

The minority groups within a neurotic society are similarly subject to error. The anxiety of the whole society multiplies the fears and anxieties of its parts. These groups, in their concern over their individual plight, and in their proper wish to make more secure their own predicament in an unsure world, press their particular cases so vigorously that they sometimes introduce new internal dissension. A nation and a people upon which the stability of the whole world depends must struggle constantly against this sort of fissioning process. The best antidote for it, of course, is the even-handed treatment of all blocs and minorities and factions. Even this does not relieve each element in the society from the obligation to keep in mind the general welfare in struggling for the furtherance of particular interests. There is no element in the American society that does not have more to gain as one of the family than it can hope for as a family of one.

All of these problems, foreign, domestic, and mental, require of each of us sacrifices of a kind to which we have not been long accustomed. Americans have demonstrated, times without number, their willingness to support the national purpose with taxes and with arms. Even more now is to be required of each of us. No nation can discharge its role in modern society without an informed people. Each of us must expect to devote to the study of the problems of our country and of the world more time than we have dedicated to that purpose in the past. We must become so aware of the duty to be informed that we accomplish it as cheerfully as we have fulfilled the other duties that democracy imposes upon us.

AN EXPLANATION

Although the foregoing message was essentially directed to Americans it is reprinted in the Journal because of our conviction that Canada's interests are inseparable from those of the United States. To the extent therefore that the Canadian attitude may resemble that of the U.S., Mr. Wiggins' message is of serious concern to us.

NEW MARCONI FREQUENCY MODULATED STATION CFCM

J. GETTENBY and A. A. BOOTH
Engineers, Canadian Marconi Company, Montreal.

The Canadian Marconi Company's new frequency-modulated station currently being installed at Montreal comprises the following units: Operating Console, Termination Cabinet, Transmitter and Antenna.

Operating Console

The operating console, attractively finished to conform with the transmitter appearance, includes two high quality, constant speed transcription turntables in addition to the main speech input equipment which comprises a standard Marconi type AB11-B Studio Consolette. This consolette is a compact, high quality assembly designed in accordance with Department of Transport regulations laid down for A.M. and F.M. station operation, and is approved by the Canadian Electrical Standards Association. With its separate power supply unit, the WE21-B, it is designed to operate from a 115 volt a-c source of either 60 or 25 cycles.

The AB11-B consists of a number of individual units mounted in a compact sheet steel cabinet of modern design, the whole assembly being arranged for ease of operation and of servicing. Designed to handle four microphones, two sets of transcription equipments and any one of four remote lines, the AB11-B has an overall gain through the microphone channels of 100 db. and through the transcription channels of 70 db. For remote line programmes an overall gain of 50 db. is available. In addition to the main programme channel a monitor channel is incorporated, which may be used either for monitoring or for audition purposes. The monitor amplifier used in this circuit will deliver a maximum power output of 7 watts with 5 per cent distortion. It is arranged to feed four 600 ohm speakers simultaneously. All mixer controls and switching facilities are located on a control panel. The layout of this panel has been designed for ease of operation, having those controls associated with one another grouped together.

There are four microphone pre-amplifiers in the consolette, each of which is a two stage transformer-resistance coupled audio amplifier using two type 6SJ7 tubes. To ensure even frequency response, low distortion and maximum gain, the input and output transformers are of the shielded type and use MU metal laminations. The input transformer utilizes a triple shield, and both are balance-wound for hum reduction purposes. The tube heaters are supplied from a 12 volt d-c source in the power unit, both tubes being connected in series. The input tube is operated as a class A-1 pentode, while the output tube is operated as a class A-1 triode. The pre-amplifier is capable of handling input levels from –75 VU up to –30 VU and the hum pick-up of the input transformer is less than –135 VU. This transformer is provided with adjustable input impedances of 30, 50, 200 or 250 ohms balanced to ground, since these impedances are the most common in the broadcast type of high quality microphone. The output impedance of the pre-amplifier is 600 ohms. The frequency response of the microphone pre-amplifier is within 1 db. from 30 to 10,000 cycles and within 1.5 db. to 15,000 cycles. The distortion is less than 0.5 per cent at maximum level and the overall gain is 55 VU.

Each of the two transcription amplifiers is a single stage transformer coupled amplifier using a 6SJ7 tube operated as a class A-1 pentode. The amplifier is intended to provide the requisite degree of pre-amplification from standard transcription equipment. In addition, this unit carries the repeat coil used in the remote line circuits. As in the case of the microphone amplifiers the transformers are enclosed in metal shields and are manufactured on MU metal cores. Each amplifier has a gain of 20 db., a frequency response of within 1.5 db. from 30 to 10,000 cycles. Each has a distortion factor of less than 1.0 per cent at maximum gain. The input and output impedances of the amplifier are the same, being 600 ohms.

The programme amplifier is intended to take the output from the mixing circuits on the output of the microphone and transcription amplifiers, and to raise such output to a sufficient level to feed outgoing lines to the transmitter. The programme amplifier in the AB11-B is a two stage amplifier, transformer coupled throughout, and uses one 6SJ7 tube, triode connected, as a driver for the two 6K6GT/G tubes which are also operated as triodes in a push-pull class A-1 circuit. This unit is the heart of the amplifying system and its input circuit, with an impedance of 600 ohms, is arranged through matching circuits, to take the outputs from any or all pre-amplifiers with proper input impedance matching under all possible combinations.

The output is arranged to feed either a 300- or a 600-ohm balanced line. Three high quality transformers are used in this unit, all being mounted in shielded cases; the input transformer is humbuck wound on a MU metal core. The frequency response on this unit is within 1 db. from 30 to 15,000 cycles; its gain is 50 db. with a distortion of less than 0.5 per cent at normal level. The programme amplifier is designed to take input levels of from –40 VU to –20 VU and is normally operated with a gain sufficient to feed the outgoing lines at between 0 and + 8 VU. The hum and noise pick-up at this normal output level is greater than 65 db. down.

The monitor amplifier is identical to the programme amplifier, but the 6K6GT/G tubes are replaced by 6F6's in order to provide the output to drive the monitor speakers. These output tubes are operated in the same manner as those in the programme amplifiers as class A-1 triode push-pull amplifiers. The output available for the monitor speakers is 7.0 watts at a distortion percentage of 5. The input impedance is 600 ohms and the output impedance is either 150 ohms for four speakers, or 600 ohms for a single speaker.

Besides the main amplifiers described above, two other units are incorporated in the consolette. One of these is the test meter unit, which is arranged to read the cathode voltages of all the operating tubes of the amplifiers in addition to the HT and LT d-c voltages. The other unit is the relay control unit. These relays are provided so that, with proper terminal panel connections, arrangements can be made to silence any monitor speaker when a microphone set up in the same studio is placed in circuit.

In addition to the normal microphone and transcription amplification circuits other facilities have been provided in the AB11-B. One is the often useful remote cue circuit. This circuit enables the user to dispense with order lines for remote circuits. This circuit is arranged in such a way that the signal from the monitor amplifier is fed into the remote line when the remote line key is in neutral position. When this key is moved to either of its two operating positions the signal is removed before the line is connected, thus preventing singing without any attention on the part of the operator. With proper setting of microphone and monitor key switches a two way conversation may be carried out over the remote lines before a remote programme is fed to the consolette. The amplitude of the signal being fed into the cue circuit is set by a fixed pad which may be set on installation.

Allied to the cue circuit, but more likely to be used in the normal course of operating, are the talkback circuits, which enable the operator to talk to a studio without interrupting a programme in progress in another studio.

The output level of the programme channel of the consolette is fed to a volume indicator on the control panel. This meter, arranged to read the level across the outgoing 600 ohm line, is of the high speed type with the minimum of pointer overswing now considered to be standard for all modern broadcast equipment. The scale is calibrated from –20 to + 3 VU with an additional percentage scale ending at zero VU. To provide for extension of the range, a multiplier is included, which provides for an additional 24 VU in steps of 2VU. This multiplier is located on the control panel, and the output level to the programme line will be the sum of the two readings.

As previously mentioned, the WE21-B power supply unit is supplied with the consolette. This power supply incorporates all components required to produce the necessary voltages for operation of the equipment. It is arranged for floor or table mounting, and is completely shielded to localize a-c hum. The power unit actually consists of two separate rectifier sections. One of these supplies all the high tension voltages for the consolette and the 6.3 volt a-c for the programme and monitor amplifier tubes. The other utilizes a dry type rectifier and supplies the 12.4 volts d-c for the filaments of the pre-amplifier tubes. Both rectifier systems are adequately filtered to reduce the hum on the consolette to the low levels required for speech input service. The high voltage rectifier uses a type 5U4G tube in a full wave circuit.

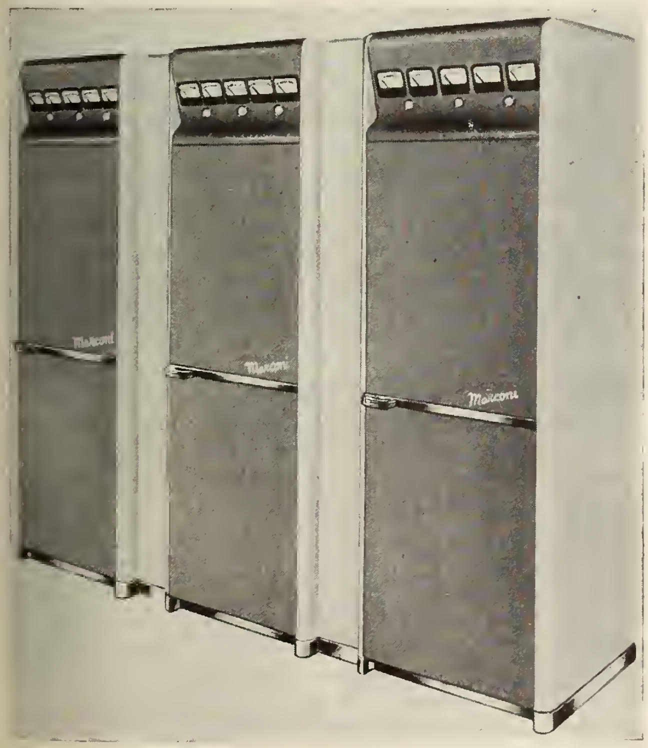

Fig. 1. Front view of the main transmitter units consisting of 250-watt unit, one kilowatt amplifier, and three-kilowatt amplifier.

Termination Cabinet

The termination cabinet is a 19-in. relay rack cabinet which is identical in height and external appearance to the transmitter units, and conveniently provides the necessary space for mounting associated items of equipment, such as the frequency monitor and line equalizers.

Transmitter

The transmitter will deliver three kilowatts of power into a coaxial transmission line leading to the antenna. It is capable of being frequency-modulated with a deviation of $\pm$ 75 kc. per sec. at all audio frequencies in the range from 30 to 15,000 cycles per second. The frequency response lies within 1 db. of the standard 75 microsecond pre-emphasis curve. The audio requirements are such that an input level of about + 8VU at 400 cycles per second will produce the $\pm$ 75 kc. per sec. deviation. At this deviation the distortion is less than one per cent, while at a deviation of $\pm$ 100 kc. per sec. the distortion is less than 3 per cent. Intermodulation distortion is less than one per cent. The frequency modulation noise level is better than 65 db. down from full modulation at all frequencies in the audio range of from 30 to 15,000 cycles per second.

A front view of the transmitter is shown in Fig. 1. It consists of three units, the basic 250 watt unit, a one kilowatt amplifier, and a three kilowatt amplifier. These units are housed in pressurized cabinets, identical in outside dimensions and appearance, each containing the power supplies, control circuit, etc., associated with its operation.

The 250 watt unit contains the modulator, a tripler-driver stage and a 250 watt output amplifier. Also included in this unit are two power supplies. The first is a low voltage supply delivering power at 600 volts d-c to the tripler and modulator output tubes, and power to an electronic voltage regulator circuit which supplies 300 volts to the modulator circuit. The second is a 2000 volt d-c supply for the plate circuit of the power amplifier.

The control circuits in the basic unit control the operation of the complete transmitter. Pressing the start button energizes the filament contactor which " locks in " on its own contacts through the normally closed stop button. This applies power at all filament circuits in the basic unit, energizes the time delay relay, and supplies control voltage to the filament contactors in the one and three kilowatt amplifier cabinets. When the time delay relay in the 250 watt unit closes, power is applied to the low and high voltage rectifiers through their contactors in the basic unit, and a control voltage is applied in sequence to the plate contactors in the amplifier units, placing the whole transmitter in operation.

All power amplifiers are protected by grid interlock relays which ensure that plate power is not applied to an amplifier before the correct drive and bias have been developed. The tubes used in the one and three kilowatt amplifiers are forced-air cooled. The blowers are equipped with air-interlock switches which prevent the application of filament and plate voltages until sufficient air flow has been established.

Overload protection is provided in the three power amplifier circuits. Excessive plate current in any one circuit will result in the transmitter being shut down. The controls, however, are wired in such manner that the time-delay relay will remain closed, and the filaments alight. After an overload the transmitter will automatically attempt to come back into operation at full power. If the overload persists it will attempt to come back at the 1 kilowatt power level. If the overload still persists it will attempt to come back at the 250 watt level. If the overload is such that it affects the operation of the 250 watt unit, the transmitter will shut down and remain this way until it is manually returned to its normal operating condition. In addition, all primary circuits are protected against sudden severe overloads by magnetic type circuit breakers.

The modulator makes use of the Armstrong phase-shift system. To illustrate its operation, attention is directed to the block diagram, Fig. 2. There are two modulator sections, each consisting of a balanced modulator using two 6SK7 pentode tubes. The control grids of these modulator tubes are excited in phase quadrature by the 200 kc. per sec. crystal oscillator section, while the screen grids are driven in push-pull by the audio amplifier output. (The symbol $\pm\triangle F$ is used here to represent the extent of the frequency swing of the carrier to either side of its mean, or centre value.) As shown by the interconnection in Fig. 2, the phasing is such that a $\pm\triangle F$ modulation is produced in one pair of modulator tubes, and a $\mp\triangle F$ modulation by the other pair. In a modulator of this type the phase swing that is produced must be kept to a very low value if distortion is to be kept to a minimum. Hence considerable frequency multiplication is required to increase the modulation to the full +75 kc. per sec. deviation at the carrier frequency. The block diagram of Fig. 2 shows how this multiplication is achieved.

Each modulator is followed by two tripler stages, one 6AC7 and one 6SJ7, a 6SJ7 amplifier, then two more 6SJ7 triplers, resulting in a total multiplication of 81 times, in each section. At the output of modulator section No. 1 there is now a modulation of

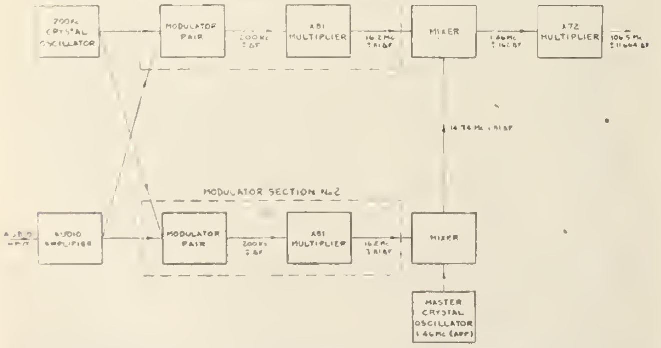

Fig. 2. Block diagram of the modulation sections Nos 1 and 2.

$\pm 81\triangle F$, and at the output of section No. 2 a modulation of $\pm 81\triangle F$. The output of section No. 1 is mixed with the output of the master crystal oscillator and the difference frequency, containing the $\pm 81\triangle$ modulation, is selected. This difference frequency is mixed with the output of modulator No. 2 in a second mixer stage and the difference frequency again selected. It will be seen that this second difference frequency is the same as that of the master crystal oscillator, but will now contain a modulation equal to the sum of the modulations produced in sections Nos. 1 and 2, that is, $\pm 162\triangle F$.

The second mixer 6SA7 is followed by additional frequency multipliers giving a multiplication of 24 times. Therefore at the output of the modulator the original modulation of $\pm\triangle F$ has been increased to $\pm 3888\triangle F$, while the centre frequency is one third that of the final carrier frequency. It will be noticed that the frequencies due to the 200 kc. per sec. oscillator have been cancelled out in the dual mixing process. These have no effect on the final carrier frequency, being dependent only on the frequency of the master crystal oscillator, ensuring the required carrier frequency stability.

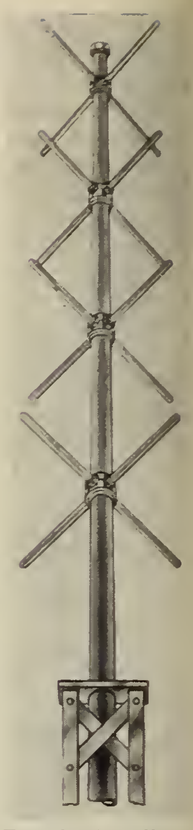

Fig. 3. An illustration of the four bay turnstile antenna.

The output of the modulator unit drives the twin-tetrode 829B in a push-pull class "C" tripler stage. This stage serves the dual purpose of providing an additional multiplication to raise the final modulation to $\pm 11{,}664\triangle F$, and of acting as the driver for the 250 watt power amplifier.

The power amplifier for the basic unit uses two 4-125A tetrode tubes in a push-pull class "C" circuit. The grid and plate circuits are of the distributed constant type, the grid line being tuned by a variable condenser and the plate line by an adjustable shorting bar. Screen neutralization is employed in this stage, being more easily accomplished than conventional cross-neutralization. The output of the 250 watt amplifier is fed to the input of the one kilowatt amplifier via a shielded loop inductively coupled to the plate tuning line, and a length of ⅞ in. coaxial transmission line.

The one kilowatt amplifier consists of a 7C24 forced-air cooled triode tube used in a "grounded-grid" circuit. Certain important advantages arise from the use of grounded grid amplifiers; neutralization of the tube grid-plate capacity is unnecessary, stability is increased, and the output of the driver stage appears in the amplifier plate circuit, contributing to the total power that may be delivered by the amplifier stage. Coaxial line elements are used as cathode and plate tuned circuits, the 250 watt amplifier output being inductively coupled to the cathode line. The one kilowatt output is inductively coupled to a length of ⅞ in. coaxial line leading to the three kilowatt stage.

The final amplifier again uses a 7C24 tube, the cir-

(Continued on page 391)

TRAFFIC AND ENGINEERING

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A paper presented before the Montreal Branch of The Engineering Institute of Canada, on February 28th, 1946

For the last twenty years, Mr. Gibala's duties have involved numerous phases of traffic and transportation with the New York City Board of Transportation, and the Police Department of that City. He has lectured on many aspects of traffic before clubs, colleges, engineering groups and on the radio. He is also the author of many articles on the subject.

During the early " twenties," the roads and bridges began to feel the impact from traffic's sudden growth. Highway transportation was rapidly moving forward. Public clamor was now changing from " get us out of the mud " to " give us more and better roads, wider, longer and straighter ".

The term traffic, as generally used, refers particularly to automobiles. This use of the word may not be exactly correct. The word traffic has a much broader meaning. It includes not only vehicles but pedestrians and other conveyances using the streets and highways. The traffic, with which we are mostly concerned, however, is the automobile.

Traffic in most large American cities follows the same general pattern. The habits of people generally follow typical daily schedules: From 8 o'clock in the morning, they start rolling into business and industrial areas, using and crowding all available transit and road facilities. From eight to about ten in the forenoon, the statistical curve of accumulation rises abruptly and tapers off until it reaches its peak, usually between two and three in the afternoon, when parking in the central business district is most dense. At this time of the day, incoming traffic begins to balance the outgoing and all available parking space is used.

From three to four in the afternoon, parked vehicles now begin to start moving homeward. All traffic, some on foot and those in street cars and buses, together with the passenger cars and trucks, move outward from the city through force of habit and convention, they occupy all the available roadway space, taxing it to utmost capacity. Those who had taken six to eight hours to come into the city now leave it within an hour or two, thus building up enormous peaks in vehicular activity along the highways. This continues on to about six o'clock, when it reaches its maximum for one hour. Peak hour conditions on our highways and city streets are a headache to all, not only to the city official, but to all the users of the road. While it is true that peak hour conditions occur only twice daily, morning and late afternoon, these two periods are the source of concern to all who plan, design, and build for traffic and transportation.

Three Traffic Fundamentals

The three traffic fundamentals, generally considered as such are: the car, the driver, and the road.

The early inventors and the pioneers in mechanical and electrical engineering pooled their resources to develop and give us an automobile. This mechanical marvel was then given to a human being, unprepared and unskilled in the art of driving, and caring little about the rights or safety of others. The early roads, many of them still with us, were entirely inadequate to meet the needs of either the car or the driver. Neither the driver nor the road has kept pace with the car. The results have often been appalling. When nearly fifty thousand human beings are killed annually by automobiles on the streets of North America, it is time for remedial action. That is the big job for engineering, working jointly with enforcement and educational officials. The blending of these three functions has already accomplished wonders. With added cooperative effort, it will reach much greater goals of achievement.

The Car

The vehicle in motion presents many interesting problems. The weight of the car and all the physical phenomena which influence its motion are all contributors which present many complications. The weight, coefficient of friction between tires and pavement, and speed are basic factors in the kinetic energy formula. On these factors depend the stopping distances in which a vehicle may be brought to rest. On them depend the lives of the men, women, and children using the highways. The engineers balance their design calculations with them. Highway curves, superelevation, and highway sight distances also take them into consideration.

The average vehicle is able to accelerate at the rate of ten feet per second per second in low gear and five feet per second per second in high gear, its average being four feet per second per second when accelerating to 15 miles per hour.

In stopping a car, the distance in which it may be brought to a stop depends upon its rate of deceleration. This rate may range to a high of 30 ft. per second per second. Deceleration rates at which people become uncomfortable and must brace themselves are in the range of 20 ft. per second. Studies have indicated that the coefficient of friction between tires and pavement varies from 0.70 on dry concrete to 0.10 on ice.

The Driver

There are more than forty-five million licensed drivers in the United States and Canada. Some are more alert than others. Many are colour blind. Others have varying degrees of intelligence and therefore react differently under similar conditions. Driver reaction time, perception time, and judgment time are vital factors pertinent to the design of highway facilities, and should be adequately considered in the preparation of highway plans. Driver reaction time, translated into terms of distance, is taken into consideration when computing vehicular stopping distance, also the safe or the critical approach speeds at intersections. These reaction time intervals, really comprise two separate functions, perception being first necessary before reaction takes place. An average working time interval for these two combined functions may, and is generally taken as one second.

During this short period of time, a car travelling at 30 miles per hour will travel 44 ft. In a confusing situation, however, judgment time may take another second or more in addition to the perception reaction time, thus bringing the total to more than two seconds in unusual situations.

Pedestrians

Normal pedestrians when crossing a roadway will walk at the rate of five feet per second. This figure is used a great deal when timing traffic signals at street intersections. In planning traffic relief measures, pedestrians are often forgotten and no provision is made for their safety or convenience. During recent years, pedestrians in urban areas, are being more adequately provided for with sidewalks, traffic signals, foot bridges, safety islands and safety zones.

We are all pedestrians most of the time and occupants of vehicles only about 15 per cent of the time. Although many courts have decreed the roadway in favour of the humble pedestrian, dry statistics reveal that the pedestrians are losers by two to one in our highway motor vehicle accidents. Compared to the pedestrian's walking rate of five feet per second, the vehicle travels 40 or more feet per second. In our towns and cities, a pedestrian is involved in three out of five motor fatalities, while in our rural areas one out of five motor fatalities involves a person walking. Approximately half of the pedestrians killed are over 50 years of age, while only 17 per cent of the population falls within this group. Night time, especially along highways of poor visibility, when less than a third of the traffic is on the road, is the period of the day when more than half of the pedestrian accidents occur.

The following are measures which may be taken to help the pedestrian in traffic. It is deemed advisable to provide safety islands and malls in excessive pavement areas, or to provide raised pedestrian safety islands at street intersections. These measures not only help pedestrians, but they tend towards better and more orderly vehicular traffic movements.

Traffic Surveys

The major objectives of traffic surveys and studies are to obtain facts pertaining to the characteristics of traffic, and thereby replace opinion with facts for analysis, conclusions, and recommendations in the development of a traffic improvement programme.

In every type of traffic survey certain essential elementary steps are required. These are a clear understanding of the purpose of the survey, the method to be used, collection of the factual data, its analysis, conclusions, and final presentation. After development of historical background of the traffic and highways, the most important step is to determine by actual field count, the amount of traffic using the many streets, as well as the direction movements and types of vehicles using certain roadways during certain hours.

In conducting the vehicle volume count, the short count method is frequently used. Traffic is counted at a number of stations at the same time as traffic is counted at a control station. The fluctuations of traffic flows at the master or control station are then tabulated and ratios computed. These ratios are then used to convert or adjust any of the short counts to peak hour or daily counts. This method is based on the theory that traffic volume fluctuates uniformly within areas and along certain streets and directions.

The vehicle volume count is the most important in the whole group of traffic studies. From this basic study it may be determined if the highway is carrying capacity volume or whether the congestion is due to other causes. Most traffic counts are taken manually. Men are stationed along the road and count the vehicles as they pass. Automatic counters are sometimes used. Although not as flexible as man power, they are economical in time and manpower, especially on long time counts, where special data is not required. After the field data is adjusted, a traffic flow map is prepared. The finished map will graphically portray an arrangement of black bands of different width to indicate the flow of vehicular traffic along the various streets and highways.

Parking Survey

This survey includes a tabulation of all parked cars within a designated area. Parking studies are made to determine not only the needs of those who park at the curb, but to ascertain the parking needs of commerce and industry, including the future needs for parking facilities. This study goes into the physical aspects of the problem, i.e., how much parking is there, how much space there is to accommodate it, and how much of it is occupied during the different hours of the day, and for how long. This type of survey is made by assigning checkers to tabulate the license plates of cars parked at the curb. While the checkers are making their semi-hourly checks they also observe and record parking violations, etc. This data is later summarized, graphed and mapped for presentation as an important component of any traffic survey.

Speed Studies

In addition to the other related traffic data it is often desirable to obtain the speed of vehicles along certain streets. This data is obtained by timing the travel of selected sample vehicles between measured points along the road on the approach side of intersections, at curves or in high accident locations. Another method used for speed studies is through the use of the floating car. This is done by driving a vehicle in the stream of traffic and just floating with the traffic and not overtaking any more vehicles than absolutely necessary. From the tabulated and summarized data of this study, delays may be classified and shown graphically.

Origin and Destination Study

The volume and speed of traffic in cities or along certain streets may not satisfy the needs of the information required, it may also be necessary to know where the traffic comes from and where it is going, also over what routes it travels, and how often. This type of study would be called an origin and destination study. The direct interview method is a slow and tedious process. It entails the stopping of vehicles at strategic points along the roadway. The points usually chosen are signalized intersections, and bridges or their approaches. The drivers are asked a few well chosen questions, the fewer the better, i.e.: Where are you going? Where are you coming from? How are you going? How long will you stay, and where will you park?

A variation of this method may be used in which a stamped and addressed postal card is given to drivers to fill out and mail while he is momentarily stopped at traffic signals. Some of the other methods may be any of the following: the license plate method, the precoded tag method and variations of all of them. At large manufacturing plants, it is sometimes convenient to obtain data from the plant personnel records or by requesting employees to fill out questionnaires.

After at least a ten per cent sample is obtained, the field data is summarized and presented in the usual manner.

Cordon Count

The cordon count is a vehicle volume count taken in a manner which will show the total volume of traffic entering a selected area, such as any industrial, business or residential area. This study will show the number and types of vehicles which enter and leave the area, together with the accumulation within the area, according to time of day. With the vehicles the number of passengers using the different conveyances could be studied. This could also include the mass transportation carriers.

Pedestrians

Pedestrian circulation in business areas of cities is always a vexatious problem. The chain stores of the cigar or notion variety thrive on it. Advertisers compete for space to capitalize on their passing glances. Police at busy intersections work hard to guide and protect them. A comprehensive traffic survey always includes a count and tabulation of pedestrians at busy and hazardous intersections.

Traffic Control Devices

Traffic control devices are the tools of traffic engineers and enforcement agencies. These tools properly distributed along the highway system give courage and aid to the driver, they warn him of impending hazards, and guide him safely in his journey. The white line in the centre of the road clearly designates the line of separation between opposing streams of traffic, it is recognized as one of the most useful aids in safe traffic control and regulation. Other variations are the lane and stop lines, to outline the lane and to designate the place of stop. Although the economic benefits of properly used traffic control devices are difficult to measure, it may be definitely stated that the benefits derived from their use far exceed the efforts and costs to place and maintain them.

Signs

Without signs along the roads, our travels would not only be confusing and hazardous, but would result in chaos. The speed and " no passing " signs warn us in areas unsafe for such excess speeds or manoeuvres. Such signs are placed only after a thorough study of the road and highway conditions, and after an analysis of accident experience. The coefficient of friction between tires and pavement under varying weather conditions, together with sight distances for vertical and horizontal curves, are balanced with driver habits and his psychological and physiological responses. The experience of similar past conditions are also weighed and considered. The conclusions developed by police, engineering, and educational officials must then be transmitted to the drivers on the road. The only efficient and practical way to convey such information to drivers is through the medium of properly designed and placed traffic signs.

Traffic signs perform a most important function in traffic control, and new types of signs are constantly being developed. There seems to be a tendency towards the use of signs which are nearly equally visible during day and night. The use of the electrically illuminated sign is restricted to locations only where electricity is available, this type of sign is costlier and requires more maintenance to restore burned out lamps. The reflectorized signs are gaining in popularity among highway and enforcement officials because of their wide adaptability and economy.

Traffic Control Signals

The traffic control signal may be a source of delay or it may materially and safely expedite the flow of traffic through a group of signalized intersections. Traffic control signals involve public expense, and their use is reserved to locations which require remedial measures to safely expedite the movements through the intersection. Traffic signals are not the cure-all for all traffic evils that many are led to believe, their use should be weighed in the light of restrictive capacity which they have upon traffic.

The efficient timing or setting of traffic signals sometimes requires the exercise of great ingenuity to develop or design a progressive system of traffic signals along a highway having variably spaced intersections. A progressive signal system of traffic lights is one having a group of signals along a highway which are timed in such a manner that the signals show a green or " go " indication to groups of vehicles travelling at the design speed. The design of a progressive signal system is met with many obstacles, some of these being the spacing of signals, the volume of traffic, the length of the signal cycle used, and the demands of the cross traffic. Great stress is usually placed on the cycle length because success or failure often depends on it.

The selection of the design speed often wrecks the whole signal system by congesting traffic during the most critical period of the day. As for any other engineering design, there must be a definite purpose in mind when figuring out a progressive system, especially for highways which carry spasmodically heavy traffic.

It is better to design for normal conditions and let peak conditions take care of themselves within the limits of the highway and system capacity. This type of design would provide for efficient operation for more than 90 per cent of the day. It would generally operate satisfactorily under peak conditions with a slight reduction in average speed. When several hundred traffic control signals are in use, as in the business districts, it becomes a rather involved situation to maintain accurate co-ordination between all the signals in order to provide uninterrupted travel in the area or with the minimum of delay. This is usually done by timing all signals relatively with respect to some master clock maintained in the area. In this manner the relative timing of the beginning of green of all the signals in the city is scheduled and kept in relative time relation, to the second, with respect to the master zero.

In traffic signal work, the little synchronous motor is the heart of the whole mechanism. It drives the timing mechanism to alternately display the green and red light and thus distribute the right of way along the thoroughfares equitably and without quibble. It is a reliable piece of mechanism which carries a heavy burden in the field of traffic control. There are several types of traffic signal controllers in general use and most of them are satisfactory. One particular type of signal timing device is of the type known as the vehicle-actuated type. The signals having this equipment may be set to give the right of way or green period to the principal street carrying the largest volume of traffic continuously, until there is a demand by waiting traffic on the cross street. When that call for the signal comes from the cross street by means of an electric impulse, the timer automatically resets itself to allow sufficient time for the cross traffic to safely clear the intersection.

Most people who are guided daily by the traffic signals on the road, have but the slightest conception of their design or construction. The red light is always at the top, firstly because it is the most important and secondly to provide a uniform position for the two or three per cent of our colour blind drivers who cannot distinguish between red or green, but who can see whether the top or the bottom light is lit.

In a standard three tier, four face signal lantern, there are twelve lamps and twelve reflectors. The coloured lenses through which the light shines are scientifically and mathematically designed to meet optically precise requirements. The colour in the glass for example must meet specific requirements with respect to colour exactness, together with light absorption and transmission. The proper positioning of the signal standard is a very important function requiring knowledge and seasoned experience about the many phases of traffic behaviour during the four seasons of the year and the hours of the day.

Street Lighting

Highway lighting in recent years has been receiving its due share of attention. While the design and the manufacture of headlights for automobiles have made rapid progress in keeping with the pace of the automobile, no one has yet come forward to suggest that night driving can be either as safe or as comfortable as day driving. According to the National Safety Council, the mileage death rate at night is about three times the day rate. In cities there are almost ten times as many fatal accidents per mile of travel between 3 and 4 o'clock in the morning as there are between 9 and 10 a.m., which is considered the safest hour. It is not intended to infer that it is economically prudent or even necessary to increase night illumination to that of daytime, but it is generally conceded that better street lighting is needed on many of the heavily travelled roads, and it is economically practicable to provide properly distributed illumination of sufficient intensity for safe, comfortable and convenient use of streets and highways at night.

Highway Design

Engineers no longer think of the highways in terms of only so many cubic yards of cut or fill, but rather in terms of what the road will carry. Into highways of the future, engineers are going to design safety and facility of movement. We will build roads in such a manner that drivers will find it easier and more convenient to drive safely and with regard towards others, rather than in a careless or haphazard manner.

These highways are not considered in the light of any competitive sense with any other modes of transportation. Some of them will bypass areas of congestion and hazard, and thus open up access to commerce and industry at the fringes of cities and towns. Others will be built merely as short connecting links between communities, and to serve as connectors to the railways and waterways, many of which are in dire need of more convenient ingress and egress facilities. It is to be wondered whether or not the apparent lack of adequate access and exit facilities at many of our water-way and railroad terminals is responsible for such phenomenal growth in over-the-road freight movements, at the expense of the other modes of transport. Maybe, that is something worth looking into. It may yet come to pass that the highways of tomorrow will give better service to water-way and railway terminals.

Traffic Noise

For the purpose of this discussion, we will deal only with one aspect of sound, its relative loudness to the human ear, as it is determined scientfically. A comparatively loud sound under certain conditions may be very annoying, and the same sound of equal intensity under different circumstances may be entirely inaudible to the same human ear. The reason may be that the sound is absorbed by the background noise or the general surrounding sound level, of which the human ear may be entirely oblivious, but which is present nevertheless.

According to the Acoustical Society of America, certain standards have been set. These are now generally used in describing the loudness of sound. When measuring sound, the results of the units of difference are expressed in decibels. If the sound is louder, the number of decibels is higher. A level of one decibel represents roughly the weakest sound which can be heard by a person with very good hearing. In practical noise measurements noises below 40 decibels may usually be disregarded.

In order to avoid any human error in the measurement of sound, scientists have devised a means by which sound may be accurately measured and compared. This instrument comprises a microphone, a radio amplifier, and a micro-ammeter calibrated to indicate loudness units in decibels. It may be placed anywhere and sound levels ranging from 24 to 130 decibels may be measured. For the purpose of illustration, in the woods on a calm day when quiet prevails, when we could hear the rustle of leaves on the nearby trees, we would read about 18 decibels on the sound level meter, while a whisper five feet away from the meter would record 25 decibels. Or, we could go to New York City at midnight and measure sound levels of 45 decibels. A pneumatic rock drill or riveting hammer would deafen us with 120 or 130 decibels. Heavy city traffic would show up in the range 90 to 95 decibels

Yet it is surprising how rapidly traffic sounds may be absorbed or deadened by means of just plain shrubbery or the foliage of trees, in a comparatively short distance. It is remarkable how a few trees and shrubbery may insulate large areas from traffic noises or sounds. It must be remembered however, that trees also may do considerable damage to traffic if not properly planned and distributed, and they should not obstruct traffic signals nor signs, or impair the lighting from street lights.

Traffic Congestion

Traffic congestion through this continent has developed to a situation which has aroused not only the feelings of drivers and pedestrians, but also of business and industry. Fundamentally, traffic congestion may be defined as a condition where the roads are unable to expeditiously carry traffic wanting to use them. Let us accept this simple definition and delve deeper into the apparently simple complexity of congestion. The business and industrial areas of large cities are the focal points of attraction for thousands of persons who daily make round trips from their homes: they go to work, to shop, transact business, for amusement, etc.

With all the recent talk of traffic congestion, most commentators have lost sight of one of the most basic causes of the present traffic situation. We have known for some time that our roads were over-crowded, and that traffic has risen steadily during recent years, but most of us have ignored or failed to comprehend another steady and inevitable force that has crept forward, over the past few years, to build up concentrated activity on the highways, especially in the urban areas. Some people call it a rise in the standard of living, others say we can produce more by working less; anyway, society welcomes it. So it is up to the engineers to compute the resultant and to relieve the congestion.

During the great depression little more than ten years ago, a tendency towards a shorter week was started, to spread employment. This has not only increased our leisure, but during the reduced working period it has concentrated all types of activity, including traffic on the highways. Simple calculations show that fuel deliveries for heating alone on a five instead of a six day per week basis, increased 20 per cent. Taking a square mile in any of the larger cities, having an approximate 200-day heating period per year, about 10,000 truck loads of fuel would be required to properly heat buildings in the area. The increase in truck activity on the roads from this phase alone would be from 50 to 60 truck loads per day. When all other deliveries and transportation activities are similarly increased, one can readily visualize the concentration in traffic activity from this source alone.

NEW MARCONI FREQUENCY MODULATED STATION CFCM

(*Continued from page 386*)

cuit being the same as for the one kilowatt unit. The control circuits of the one and three kilowatt amplifiers are basically similar, but since the output stage must deliver the higher power, its power supply is of necessity larger in capacity.

Antenna

The antenna is a 4-bay turnstile located in excess of 400 ft. above street level as seen in Fig. 3. The basic turnstile consists of two half wave dipoles crossed in the horizontal plane and fed 90 deg. out of phase. The resulting radiation is horizontally polarized and the radiation pattern is approximately circular in the horizontal plane. The pattern can be changed from circular to oblong by making the ratio of the powers in the two dipoles different from unity.

Energy radiated in a vertical direction is wasted for most purposes. Several crossed dipole assemblies are therefore stacked vertically to compress the radiation into the horizontal direction. This antenna has four turnstile sections or bays, stacked a half wave-length apart giving a power gain in a horizontal direction of about 2.5.

Antenna Construction

A 4 in. iron pipe is used as the central support member, thus making it possible to conceal the feeders and heaters within same so as to give the antenna a neat appearance. The support member is broken by steel castings at the bays. These castings support the insulators and radiating elements, which are made in two separate quarter-wave sections for mechanical convenience and which, when mounted in place, form two half-wave elements. The monopoles (quarter-wave radiators) are hollow and contain heaters for de-icing. The central support tube also has one heater mounted internally below each casting, for de-icing purposes.

The feeders are ⅞ in. copper coaxial cable and the entire feed system is gas-tight so it may be filled with nitrogen from the transmitter end of the feeder. The group of dipoles fed 90 deg. out of phase with the others are fed through an extra quarter-wavelength of feeder to accomplish the phase shift.

The heaters all have one side grounded to the antenna structure, and are fed from an isolating transformer having two secondary taps permitting operation at maximum, one-half or one-quarter heat, depending on circumstances. The mounting of the heating elements has been so arranged that should the heaters be accidentally energised on a hot summer day the temperature rise will not be great enough to damage soldered connections, yet sufficient heat supply is provided to handle the most difficult icing conditions likely to arise.

The antenna will handle up to 3 kilowatts R.F. power, the restriction being imposed by the necessarily small coaxial feeder lines used within the central support member. At 3 kilowatts a safety factor greater than 50 is provided. Power consumption by the de-icing heaters is approximately as follows:—maximum heat, 3600 watts; half heat, 1800 watts, and quarter heat, 900 watts.

STOP THE PRESS!!!

The Institute's Conference on Community Planning originally scheduled for November 13th and 14th at Toronto will be held on October 2nd and 3rd at the Mount Royal Hotel, Montreal. This change has been made so that the conference will coincide with the annual meeting of the Community Planning Association of Canada, thereby permitting persons to attend both meetings with the minimum of expense and inconvenience. A detailed notice will be sent later by direct mail to all members.

From Month to Month

News of the Institute and other Societies, Comments and Correspondence, Elections and Transfers

Note: The following message written by the President of the Association of Professional Engineers of Ontario, Dr. George B. Langford, was mailed to every member of the Association. In the hope of spreading the challenge the *Journal* has asked permission to reprint it in full.—(ED.)

FLOOD CONTROL AND THE ENGINEER

LET'S CALL A SPADE A SPADE

The disastrous Spring floods which have swept Southern Ontario this year offer a peculiar and direct challenge to the Engineering Profession as well as to the public generally.

The present situation in our Province is one which is growing increasingly worse as time passes. Each major flood is worse than its predecessor — we are having greater and more damaging floods today than a generation ago. The whole situation is deteriorating. There is no denying the fact that we will always have high water in Spring, but it should be taken down to the lakes in an orderly and controlled manner, and not allowed to run riot.

Flood control is nothing new. It has been practised since early Biblical times in Egypt. It has been developed under such auspices as the Tennessee Valley Authority until the whole problem is understood and methods of control well known. Why then do we, in Ontario, allow this regular devastation of so much property, and do relatively nothing about it? Are we as a people so dumb that we cannot appraise the situation? Are we so backward that we cannot develop a solution for the problem?

The answer to both these is in the negative. We are aware of the situation and we possess the ability to solve it. Why is not something done about it? The answer lies in the apathy of the people of this Province. We have become a race of buck-passers. I believe that many of us would stand and watch our homes burn and do nothing about it because we had insurance. That is precisely what we are doing in the matter of flood control, except that we have no insurance. We are watching the precious top soil of our farms being carried away, we see the waters flooding other farm areas and inundating towns and cities and we as citizens do not even raise our voices in protest.

The Professional Engineers are a group of 6000 men scattered throughout the Province who should understand this problem. Our training and experience make us well suited to comprehend such things. How many of us have ever bothered our heads about it? Some of our members have done a great deal on this problem but the rest of us as citizens as well as engineers ignore it instead of accepting it as a great challenge.

The present status of flood control administration is largely a local matter. It will be left to the municipal governments to take whatever action is to be taken. Now is the time for engineers to make their weight felt. You do (or should) understand the problem. You will benefit both directly or indirectly in its proper solution. You, as a citizen will either pay the cost of correcting it, or will continue to pay to repair the damages for years to come, and see the priceless heritage which has been given to us in Ontario slowly pass into ruin.

Our Association is striving to place the engineer before the public in his proper light as a member of a learned profession, and a citizen of some substance. Now is our opportunity to demonstrate the truth of the Association's assertions. There is a great opportunity for all of us as professional men and as citizens.

Let us study the problem and develop sound opinions on our local problems. Let us take an active part in the deliberations of municipal governments when they deal with such matters. Let us take our places as men and citizens of this fair country and not act as a race of mice.

STUDENT CONFERENCE

In 1946 the Institute carried out an experiment of far reaching significance. It called together at the Annual Meeting the presidents of all the undergraduate engineering societies in Canada. Every university at which an engineering degree was given was represented, and the conference lasted three days.

The purpose was to make a close study of the student situation to discover additional ways and means by which the Institute could increase its usefulness. It was felt that the situation could be best analysed by intimate discussions with the students themselves—getting it "right from the horse's mouth".

The experiment was a success, and a second conference was called for the 1947 Annual Meeting. The results have confirmed the wisdom of the Institute's decision to make it an annual event. The students have set up a preliminary organization to keep the societies in contact, so that the matters under discussion may be kept alive before the societies and advanced between conferences.

One of the most useful objectives of the conference (which does not appear on the agenda) is to bring this group of from twelve to twenty leading young men into contact with senior engineers, in an atmosphere of professional deliberation and good fellowship. Such contacts are of far reaching importance to men of this age and at this stage in their development. It is apparent that the experience of participating in the professional sessions with men who are already a success in the profession, of meeting them in the many non-technical and informal activities, is a great aid to growing up in the profession. Incidentally it is good for the senior engineer to have this opportunity to talk with this selected group.

It is an expensive project, as the Institute meets the costs, but it will pay real dividends in service rendered to the students and thereby to the profession.

1947 Conference

This year's conference was presided over by Dr. G. R. Langley, chief engineer of the Canadian General Electric at Peterborough, and chairman of the Institute's Committee on the Training and Welfare of the Young Engineer. President Grant who presided at last year's meeting was also in attendance all day. There were thirteen student delegates and observers, with ten other observers representing professional societies niversities and industry. Two very welcome guests n this latter group were H. H. Henline of New York, national secretary of the American Institute of Electrical Engineers and C. E. Davies of New York, secretary of the American Society of Mechanical Engineers.

The agenda included a review of the action taken n the resolutions passed at the last conference, and he following general headings—

- Employment—summer and permanent
- Salaries and working conditions
- The Institute
- Counselling
- Prizes and loans
- Non-Canadian societies
- Meetings of student societies
- Extension of engineering course to five years.

To give leadership in the discussions J. M. Dymond, irector of the Bureau of Technical Personnel spoke o the conference on employment and R. E. Heartz, ice-president and chief engineer of Shawinigan Engineering Company, on salaries and working conditions.

The following resolutions represent the opinions and ecisions on the various subjects discussed. These ave been forwarded to the Institute's committee for tudy and recommendation, and to the deans of engineering for consideration at their annual meeting.

Resolution No. 1—Employment

With respect to employment of the student engineer nd the graduate engineer, be it hereby resolved that:

(a) The student engineer must familiarize himself with the opportunities and type of work in all fields of engineering to enable his developing the proper enthusiasm for his chosen branch and to give him an understanding of the future work in all branches of engineering. This familiarization may be achieved by co-operative efforts of the student, the university administration, the engineering society, and the Engineering Institute of Canada.

(b) The undergraduate society in engineering at each university should take a greater interest in providing employment for its members by keeping in contact with the Bureau of Technical Personnel and local industrial concerns.

(c) If personal interviews are to be made by employers, the undergraduates as well as the graduates should be interviewed.

(d) Personal contact should be maintained between each university and the employment agencies by having a representative of these agencies resident on the campus. This representative would be preferably from the Bureau of Technical Personnel or a member from the local branch of the E.I.C.

(e) A co-operative training scheme should be introduced between labour and the universities to provide balanced periods of employment and study during the student's undergraduate years.

(f) Industrial firms should be encouraged to employ the same students each summer, giving them a varied training program each summer. Such a program can result in proper application of the student's ability and optimum results to the industry concerned.

Resolution No. 2—Collective Bargaining

In discussing the possibilities of collective bargaining becoming a tool of the engineer, the student delegates were agreed that collective bargaining could possibly slightly raise the material standards but that the professional standards of engineering would suffer and be greatly lowered. It was felt further that what small benefits might result would be offset also by the antagonism produced between employers and employees. The delegates reasoned that in engineering a man can get ahead and succeed by working hard—showing ability, initiative, and perseverance and can get this advancement without the aid of collective bargaining.

With respect to use of collective bargaining by the engineering profession in Canada, be it hereby resolved that:

Collective bargaining for the engineering profession will do more harm than good in that it will tend to lower the professional standards. The organization as a profession must be considered first, with any movement towards trade-unionism left entirely alone.

Resolution No. 3—Case Histories

A survey should be made to give an outline of the work of all branches of engineering. Such short "case histories" would be available for the engineering student and should include a classfied index giving names of engineers who are engaged locally in the particular field of engineering.

Resolution No. 4.—The Engineering Institute of Canada

The student delegates enjoyed the privilege of discussing methods by which the E.I.C. could help the engineering student. Although the students feel that it is hardly their place to decide what means the E.I.C. should adopt, the following suggestions are put into resolution form in keeping with the form of this committee's report.

With respect to the ways in which the E.I.C. can help the engineering student, be it hereby resolved that:

(a) The local chapters of the E.I.C. should provide speakers for engineering societies to speak on technical and vocational subjects, and that the local chapters and the universities should hold exchange meetings of both a social and business nature.

(b) The E.I.C. could survey a number of existing industrial films in an effort to build up a film library which could be used to advantage by the engineering societies.

Resolution No. 5—Prizes

That a student's prize given by the E.I.C. be a distinctive badge given to the top 5% of the graduating engineering class of each university on qualities of ability and leadership.

Resolution No. 6—Non-Canadian Societies

Because it is felt that the prestige of the Canadian engineer depends a great deal on the strength of the E.I.C., every engineer should belong first to the E.I.C., making it the one all-embracing engineering organization in Canada, but he can derive benefit also by joining non-Canadian societies.

Resolution No. 7—Continuity of Conferences

RESOLVED that the conference of student engineers sponsored by The Engineering Institute of

Canada be an annual affair to meet under the sponsorship of the Institute under the name of The National Conference of Engineering Societies of Canadian Universities.

TOWARD INTERNATIONAL STANDARDS

The first meeting of the Council of the International Organization for Standardization (I.S.O.) was held in Zurich recently. A preliminary meeting of representatives from 28 nations had been held in London last October at which the constitution was drafted.

The council of I.S.O. consists of the National Standards bodies of Australia, Belgium, Brazil, China, France, India, Norway, Switzerland, the U.K., the United States and the U.S.S.R. Mr. Howard Cooney, the U.S. delegate, was elected President at the London meeting and presided at the Zurich council meeting.

The meeting was held jointly with the International Electrochemical Commission (I.E.C.) and one of its results was a recommendation by I.E.C. to its membership that the two organizations should affiliate. In addition, an extensive programme of technical work has been drawn up for submission to the standards organizations in the different countries.

OFFICERS OF CHEMICAL INSTITUTE

The Institute received with interest the recent announcement listing officers of the Chemical Institute of Canada for the year 1947-1948. The new President is Dr. P. E. Gagnon, F.C.I.C., M.E.I.C., Dean of Graduate Studies, Laval University, Quebec. Mr. T. W. Smith, F.C.I.C., of Canadian Industries Limited, Montreal, is vice-president. Chairman of the Board of Directors is Dr. Leon Lortie, F.C.I.C., of the University of Montreal. Mr. Eric B. Lusby, of Imperial Oil Limited, Sarnia, Ont., has been elected treasurer.

A.I.E.E. SUMMER MEETING HELD IN MONTREAL IN JUNE

A full programme of technical papers, business meetings and social events featured the A.I.E.E. Summer General Meeting convened at the Mount Royal Hotel, Montreal, in the second week of June, with the E.I.C. participating. It was particularly fortunate that the International Conference on Large Electrical Systems (known as C.I.G.R.E. from the French version of the title) had chosen to convene in Montreal at the same time since a rare international flavor was thereby added to the meeting. Among the many visitors to Montreal were electrical engineers from most of the 48 States, from Mexico, India and many European countries.

The programme included some 104 technical papers, of which about 20 were presented by Canadian members of the A.I.E.E. deGaspé Beaubien, a past president of The Engineering Institute was the chairman of the joint committee for the meeting and presided at the opening luncheon at which the delegates were welcomed to Canada by Dr. C. J. Mackenzie, president of the National Research Council and also a past president of the E.I.C.

The business meeting was held on the morning of Wednesday June 11th with the retiring president, J. Elmer Housley of Alcoa, Tenn., in the chair. During the meeting the badge of the presidency was passed by Mr. Housley to the newly elected president, Blake D. Hull of St. Louis, Missouri, chief engineer of the South Western Bell Telephone Company.

Principals at the A.I.E.E. opening luncheon: Dr. C. J. Mackenzie and Dr. deGaspé Beaubien.

Entertainment during the meeting included luncheons at the Normandie Roof of the Mount Royal Hotel, a fashion show and tea for the ladies and a visit to Montreal's botanical gardens. There were inspection trips to Beauharnois, the new McGill Cyclotron and by air or steamship to Arvida and the Shipshaw Power Development. On Thursday evening the president and Mrs. Housley received delegates in the main ballroom prior to the annual banquet and dance.

Members of the Institute were invited to participate in all parts of the programme, and many took advantage of the opportunity. It was a very pleasant and profitable meeting in which Canadians were happy to be hosts.

ONTARIO PROVINCIAL DIVISION

An event of more than ordinary interest was the first meeting of the Ontario Provincial Division held during the course of the Annual Meeting on May 10th. The minutes of the first meeting of the executive and the first meeting of the Division which follow, report the business, and outline the nature of the work presently envisaged.

This is not the first division set up in Ontario. In 1919 a similar division was created to assist in securing the legislation which resulted in the formation of the Association of Professional Engineers. It was dissolved in 1923 after the project was completed.

The objectives this time though more numerous and described differently are not inconsistent with the purposes of the first organization. These are—

(a) to develop co-operative relations with other engineering bodies in Ontario;
(b) to provide a provincial body to work on the provincial interests of the twelve branches;
(c) to strengthen the Institute, and to increase its usefulness within the province.

There has been the suggestion that such an organization indicates a sectionalizing of the country — a development which members do not approve, particularly in Ontario. However there has been no thought of such a thing. The proposal sprang from a Council discussion of the Institute's expansion in Ontario whereby that province now has twelve branches — with more being considered. It was felt by the Ontario councillors that such a group could function better and do a better work if they were co-ordinated. Hence the Division. It will be interesting to watch its development.

Minutes of the Organization Meeting of the Ontario Provincial Division, held at the Royal York Hotel, on May 10th, 1947, at 9.30 a.m.

Executive Meeting

Mr. C. E. Sisson, the provisional chairman, presided at the opening of the Meeting.

Executive members present included:

(a). Members of Council resident in Ontario—Lieut.-Col. L. F. Grant, president of the Institute; Vice-Presidents W. R. Manock and W. L. Saunders; Councillors A. H. MacQuarrie, J. R. Dunbar, J. R. Carter, V. A. McKillop, P. E. Buss, Norman Marr, J. H. Irvine, A. R. Jones, Carl Stenbol, W. M. Laughlin, S. R. Frost and C. F. Morrison.

(b). Branch representatives—A. D. Harris (Border Cities); D. Ross-Ross (Cornwall); A. R. Hannaford (Hamilton); M. G. Saunders (Kingston); Geo. E. Griffiths (Niagara); Maj.-Gen. G. R. Turner (Ottawa); F. R. Pope (Peterborough); and E. R. Graydon (Toronto).

After those present had identified themselves, Mr. Sisson reviewed the events leading up to the formation of the Ontario Division. It had first been discussed at Council following the 1946 Annual Meeting, and at the March Meeting of Council it was suggested that the branches be polled in regard to a Provincial Division. A Meeting of Ontario Councillors decided to recommend formation of this body to Council. They acted on this recommendation, a vote was taken, and more than 50 per cent of Ontario members voted in favour of formation of an Ontario Division. Council then appointed Mr. Sisson Chairman pro tem., with instructions to proceed with the organization.

Mr. Sisson pointed out that Sections 69 to 74 of the Constitution of the Institute govern the actions of the Provincial Division. In accord with these sections, election of officers was proceeded with.

Moved by Mr. Dunbar, seconded by Mr. Graydon THAT:

OFFICERS of the Division consist of Chairman, Vice-Chairman, Secretary and Treasurer. (Carried).

After some discussion, the following Officers were elected:

Chairman —W. R. Manock, Fort Erie
Vice-Chairman—J. R. Dunbar, Hamilton
Secretary —E. R. Graydon, Toronto
Treasurer —Maj.-Gen. G. R. Turner, Ottawa

Mr. Manock then took the chair, and the Executive Meeting was adjourned.

General Meeting

A general meeting of the Ontario Division was called to order by the chairman, Mr. Manock.

In addition to the members of the Executive, the following members of the Ontario Division were present:

F. F. Dyer, W. S. Wilson, T. F. Rahilly, C. G. Cline, R. F. Legget, E. A. Cross, H. Self, E. A. Berry, J. W. Mills, D C. Holgate, E. F. Carson, G. C. Henderson, W. H. Lea and J. F. MacLaren.

The general secretary of the Institute, Mr. Austin Wright, was also present for part of this meeting.

Mr. Manock asked those present, who had not previously done so, to identify themselves.

It was moved by Mr. Dunbar, seconded by Mr. MacQuarrie, THAT: A hearty vote of thanks be extended from the Ontario Division to Mr. Sisson for his work as chairman during the organization period. (Carried).

Mr. Manock then called on Mr. S. R. Frost, to discuss the reasons for the formation of the Ontario Division.

Mr. Frost opened by pointing out that the words " Provincial " and " Division " were open to criticism because the function of the organization was not to separate or divide, but to strengthen the E.I.C. in Ontario.

Mr. Frost pointed out that there had been an Ontario Provincial Division in existence from 1919 to 1924, formed for the purpose of assisting in the organization of the Ontario Association.

He briefly reviewed the history of the brief presented by the Toronto Branch to Council. In the course of Council's consideration of the matter, Councillor Buss had suggested formation of an " Ontario Division " as the proper method of getting at the problem. Hence the steps leading up to the formation of this Division as listed above, took place.

Mr. Frost also mentioned the relations of the E.I.C. with the Canadian Council of Professional Engineers and Scientists, and suggested that things of this nature should be considered by the Ontario Division rather than by a single Ontario Branch.

In closing, Mr. Frost suggested that the purpose of the Ontario Division was to strengthen the E.I.C. in Ontario, and to strengthen and improve the relations of the E.I.C. with other engineering bodies in Ontario. He pointed out that the very fact that the E.I.C. in its 60th year could form an Ontario Division was a sign of health, unity and progress in the Institute.

There was considerable discussion on relations of the E.I.C. with the Ontario Association.

It was then moved by R. F. Legget, and seconded by George Griffith THAT:

IT BE resolved at this first Meeting of the newly-formed Ontario Division of the Engineering Institute of Canada, that the members here present unanimously send cordial greetings to the Ontario Association of Professional Engineers, and an assurance that the objective of this Division is to be the continuation and further development of co-operation between The Engineering Institute of Canada and Engineering organizations in Ontario. (Carried).

At Mr. Manock's suggestion, President Grant spoke briefly on relations of the E.I.C. with the Provincial Associations. He stated that he considered it the most important problem which he would face in his term of office.

Mr. Manock then brought up the question of a By-Laws Committee.

Is was moved, seconded and carried THAT:

MR. FROST be Chairman of this Committee, with power to add to the Committee as required.

Mr. Manock agreed to discuss the question of Finances for the Ontario Division at the June Council Meeting.

Meeting was adjourned at 12:20 P.M.

E. R. Graydon, *Secretary.*

CANADIAN ARMY ENGINEERS MAINTAIN ALASKA HIGHWAY

The first new bridge to be constructed on the Northwest Highway System since it was taken over from the American Army was opened at mile 674 on July 12th by Brigadier G. Walsh, C.B.E., D.S.O., M.E.I.C. The bridge was built entirely by Canadian Army personnel of No. 1 Road Maintenance Coy., R.C.E., and its 160-ft. span carries the Alaska highway over Big Creek at a point about 50 miles north of Lower Post, Y.T.

The bridge, a single span steel truss with concrete deck was commenced on November 30, 1946, and completed seven and one half months later. Construction was therefore carried out almost entirely under severe winter conditions with temperatures sometimes at —50 deg. F or lower. The first concrete was, in fact, poured on March 3rd of this year in a temperature of 40 below zero. There was an average of 20 men working during the five and one half months of actual construction and about 60 days were lost due to extremely severe weather conditions.

A second bridge of 240-ft. span is under construction at the Little Rancheria river crossing about four miles south of Big Creek Bridge.

The guard of honor from No. 1 Road Maintenance Coy., R.C.E., at the opening of the Big Creek Bridge.

STANDARDIZATION OF CORROSION TEST METHODS

Mr. C. R. Whittemore, Chief Metallurgist of the Deloro Smelting and Refining Company, will represent the Institute on a Technical Subcommittee on Standardization of Corrosion Test Methods which is being organized by the Canadian Government Purchasing Standards Committee. Those interested in obtaining information regarding the work of this subcommittee should write to the Secretary, Canadian Government Purchasing Standards Committee, National Research Council, Ottawa.

A NEW SLIDE RULE

Messrs. Pickett and Eckel Inc. of Chicago announce a new deci-log log slide rule, constructed of magnesium alloy with plastic facing. The scales on the front of the rule are so arranged that one setting of the hairline gives with each result, its square root, cube root and logarithm.

The log log scale on the back of the rule is arranged to give, for each setting of the hairline the decimal fraction to 4 and 5 figures, its reciprocal to 4 and 5 figures, the logarithm, the cologarithm and the natural logarithm. The scales read from one ten billionth to ten billion and give decimal point location.

The size of the rule is 12 1/8 in. by 2 1/8 in. by 3/16 in.

CORRESPONDENCE

Reconstruction of Halifax Reservoir

The *Journal* has received from J. A. MacGillivray, M.E.I.C., of Winnipeg, a letter commenting on the above paper by R. M. Doull, M.E.I.C., which was published in the May issue. Mr. MacGillivray is well qualified to comment inasmuch as he was superintendent for the Standard Construction Company of Halifax at the time they built the original reservoir.

Mr. MacGillivray comments as follows:

Greater Winnipeg Sanitary District

Winnipeg, Manitoba, June 23,1947.

The Editor,
The Engineering Journal,
Montreal.

Dear Sir:—

The paper "Reconstruction of Halifax Water Reservoir" written by R. M. Doull, M.E.I.C. and published in the May issue was of particular interest to me as I was Superintendent for the Standard Construction Co., of Halifax, on the construction of this Reservoir.

The original reservoir was built in the summer of 1913—all except the roof—which was completed in the spring of 1914. It was designed in the City Engineer's office and Messrs. F. W. W. Doane and H. S. Johnstone supervised the engineering and inspection.

There were some features of the construction which may be of interest; and one in particular which may have been overlooked in studying possible causes and repair schemes and in the conclusion that "the greatest single cause for the disintegration was probably frost action".

The bulk of the rock for the concrete was crushed on the site out of field boulders quarried on the side hill. The rock for the foundation was bought from the City Jail by the bushel and had all been "hand broken".

The sand was bought from schooners at the wharves and cost seven cents per bushel on wharf.

The cement was brought from England in barrels.

The concrete was poured in lifts of about four feet. Each pour was continuous and a steel plate, for seal, was placed in the top on completion. The concrete ingredients were as specified and there was no 'skimping' to my knowledge. The concrete was not 'chuted' but placed by buggies and the slump was low.

The specifications called for the addition of 5 per cent of hydrated lime to the mix for increased density.

An article by Mr. H. W. L. Doane on "Dramatic War Years at Halifax" published in the April 1946 ssue of *Water and Sewage* stated on page 58, 'Halifax water has a pH value of about 4.5, and so is somewhat corrosive".

What I wish to point out is that with this very acid water the free lime in the concrete would be attacked, which in turn would allow the water to penetrate the mass and *then* the frost would act.

Time will tell whether or not this acidity was an important factor in the disintegration since, given enough time, the acid will also act on the present concrete no matter how dense. If left to time, however, some of us who are interested may not be here to know the answer so I have advanced this 'theory' which might be investigated and, if necessary, a further protective coat might be placed on the inside of the reservoir.

Yours truly,

(*Signed*) J. A. MacGillivray, m.e.i.c.
Engineer.

R. M. Doull, m.e.i.c., the author has supplied the following further comment:

This letter contains very interesting data on the job which was not available in Halifax.

The pH value of the Halifax water was known to us. There was no physical evidence of corrosion on the inside surface of the Reservoir itself, which should have been in evidence if this had been a serious factor. I do not doubt that it had some effect but it is my belief that such effect would be secondary and not a primary cause of failure. This is also borne out by the fact that the concrete below frost line was not effected to any marked degree. I am sure the engineers responsible for the Halifax Water System will be glad to have Mr. MacGillivray's comments, and I am sure that, as he suggests, the surface in contact with the water will be watched very carefully, and if a corrosive action is set up it will be quickly detected and corrective steps taken.

Yours very truly,

(*Signed*) R. M. Doull, m.e.i.c.

STEEL AND CONCRETE PILES

June 26th, 1947.

Dear Editor,

I have read with the greatest interest the paper "Steel Rail Piles Replace Concrete Piles" by E. P. Muntz, m.e.i.c. published in the April issue of the *Journal.*

It is regrettable that the author should have omitted the name of the cast-in-situ pile described, as, by so doing and by the wording of his paper, he has cast a doubt on the quality of all cast-in-situ concrete piles.

One very important characteristic, however, divides cast-in-situ piles into two categories:

In the first group, VIBRO, McARTHUR and others, once the casing is driven to the required penetration, *very fluid or wet concrete is poured* in and, relying on gravity plus a permanent additional load or vibration to assure even flow of concrete out of the casing, the latter is retrieved.

The second group, of which the FRANKI CAISSON PILE is the prototype, *forces out of the casing very dry concrete* with a 4000-to 6000-lb. drop hammer acting immediately on *thin* layers of newly added concrete, at the lower end of the casing, while the latter is withdrawn.

The first group *has* to use concrete with a water-cement ratio of .6 to .8 as this is the only way to prevent arching of the concrete inside the casing while it is withdrawn.

The second group *has* to use very dry concrete with a water-cement ratio of .3 to .4 because, if the ratio were higher, the drop hammer falling on the concrete would stick into it and concreting would be impossible.

As a result, when the casing has been withdrawn, the first group of cast-in-situ piles has left in the ground freshly poured concrete comparable to similar concrete in a timber form used later in the superstructure. Any movement of the formwork is immediately transmitted to the mass of concrete. If it is pressed in by an outside force the level of the concrete in the formwork rises, waisting the beam or the column; if, on the contrary, the framework lets go, the concrete will follow. This is likely to occur until the concrete has set.

On the other hand the concrete left in the ground by the second group can be compared to "Prepakt" concrete which would have been submitted to the Billner vacuum process. It can be handled immediately without formwork and it can resist high surrounding pressures.

In other words, what is left in the ground in the first instance is far less rigid than the surrounding soil. The newly poured pile is like a chimney of a volcano; it allows the soil pressures to release themselves via this chimney by pushing the new concrete upwards and waisting the pile.

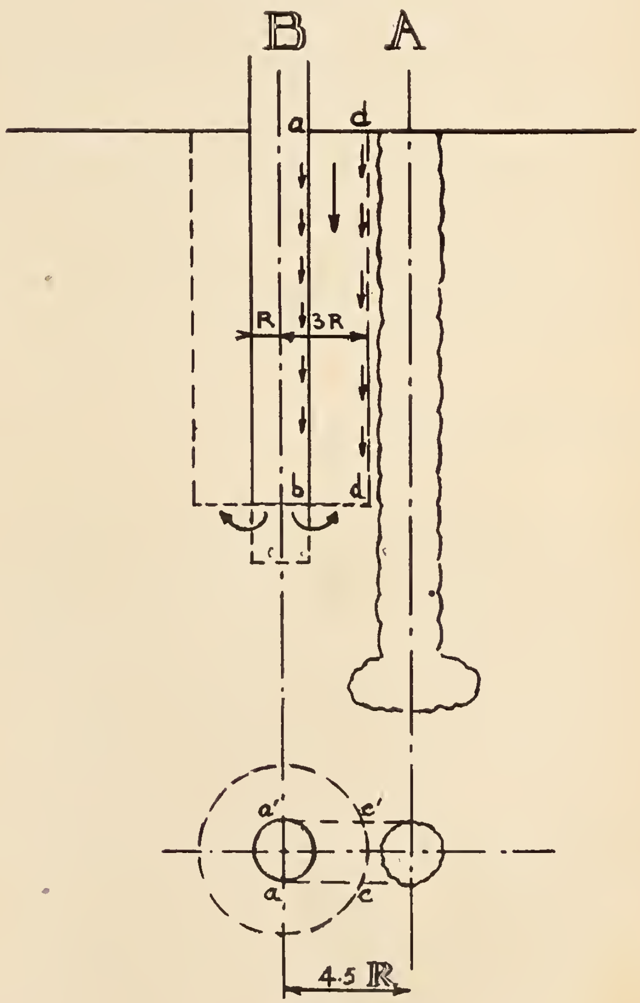

Fig. 1.

If the concrete is harder than the surrounding ground and so stiff that it can stand by itself as it comes out of the casing, the above release of pressure cannot occur and waisting of the pile is prevented.

In Fig. I, consider a pile "A" just concreted and a pile "B" in the process of being driven at a distance of 4.5 R from pile "A" leaving thus more than 2R of earth between the piles. At the next blow of the hammer, the earth located beneath the annular space represented by *bd* is acted upon by the horziontal radial pressure which is exerted by the soil located immediately beneath the base of the casing being driven.

It tends to yield in an upward direction, as indicated by arrows. This tendency is resisted not only by the weight of the soil above the annular area *bd*, but also by the skin friction between the pile and the earth, and by the shearing stresses on the outer boundary of the mass of soil located above the annular area.

Let us assume first, that the piles are driven in cohesionless material. The skin friction can be considered as acting with its full value while the driving goes on. On the other hand, the stresses on *de* depend to a large extent on the degree of volume compressibility of the earth. In loose sand for instance, the tendency to lift the sand located above the annular area *bd* may be insignificant due to lateral compression of the sand located beneath this area.

If the pile is driven through cohesive material, the skin friction will be reduced to an insignificant value due to the film of water coating the pile while the latter is driven. On the other hand the shearing stresses may have a certain value depending on how much and how far from pile "A", the cohesion of the soil will have been broken by the driving of this pile.

If in both cases, homogeneous cohesionless or cohesive material is assumed, before any horizontal movement develops at a distance greater than 3R from the centre of the driven pile, the flow of soil displaced by the driving *will have followed the way of least resistance* and the annular volume around the pile, the cross section of which is *abcd*, will have been pressed upwards.

However, instead of having homogeneous material around the driven pile, we have a pile "A", newly driven and concreted, with skin friction perhaps reduced to zero due to the film of water surrounding it as explained above, or to its liquid state if liquid concrete has been used.

Under these conditions the way of least resistance for the displaced soil may be the shaft created by pile "A" and the latter may be distorted or pushed upwards. This will happen when the weight of concrete or the weight of the pile to be displaced is less than the weight of earth resting on the section of circular area *bd* facing pile "A", plus the skin friction and shearing stresses to be overcome.

If the pile is made of dry packed concrete highly rammed in close contact with the surrounding ground, due to its stiffness, rough surface and the fact that the film of water that may have formed is immediately absorbed by the nearly dry concrete, the skin friction maintains its full value and the flow of displaced soil remains between the piles.

Longitudinal reinforcement should always be specified however in cast-in-situ piles driven in cohesive soils, and, if these bars are anchored in the expanded base of the piles, which in turn are anchored to the resisting layer below the soft soil through which the piles have been driven, there is no danger of distortion or uplift.

If we examine in any textbook, charts giving the compressive strength of concrete at 28 days under varying ratios of volume of water to volume of cement, we will notice that a .3 to .4 ratio will give a 5000-to 6000-lb. concrete, while a ratio of .6 to .8 will only guarantee a 2000-to 3000-lb. concrete.

This has been confirmed by the Franki Caisson Pile Company Limited on numerous occasions and again, recently, on blocks of concrete sawn ten feet below grade out of pile shafts on one of their contracts. Tests by engineering consultants gave a resistance to compression of 5780 and 5830 lb. plus, per sq. in. The concrete was a 1/2/4 mixture with three gallons of water per bag of cement.

The writer hopes that these simple facts will prove to be of interest to engineers and that they will limit, as they should, the consequences of the very sound remarks made by Mr. Muntz in his paper.

(Signed) L. A. Fraikin, m.e.i.c.

Personals

News of the Personal Activities of members of the Institute

G. W. Parkinson, m.e.i.c., who has been named councillor of the Institute representing the Association of Professional Engineers of Saskatchewan, is a designing engineer on the staff of the P.F.R.A., Department of Agriculture, in Regina. He is a graduate of the University of Saskatchewan, having received a B.Sc. degree in civil engineering in 1929. For two years he followed graduate studies at Lehigh University, Bethlehem, Pa., and research on the effects of clay on compressive strength, permeability and durability of concrete, after which he was awarded an M.Sc. degree (civil) in 1931.

Returning to Saskatoon, Mr. Parkinson was with the city engineers department in 1931, and worked at designing and estimating on various projects until 1936. Then he joined the staff of the Saskatoon Technical Collegiate as an instructor in mechanical drawing. He returned to the University of Saskatchewan in 1938 as an instructor and lecturer, and remained until 1946, when he accepted his present position in Regina.

Lieut.-Colonel L. F. Grant, m.e.i.c., the president of the Institute, has been elected as advisory member of the Committee on Education of the American Society of Mechanical Engineers. This followed his participation in an educational session during the summer meeting of the Society at Chicago in June.

C. E. Craig, m.e.i.c., is the new chairman of the Kingston Branch of the Institute. He is from Cobalt, Ont., a graduate of Queen's University, class of 1938, with a B.Sc. degree in mechanical engineering. He worked first for the Horton Steel Works Limited at Fort Erie, Ont., on draughting, layout and design. He joined the Aluminum Company of Canada Limited in Kingston in 1943 as a production development engineer. He is still with the company as superintendent of the tubing and extrusion department.

S. E. Flook, m.e.i.c., city engineer of Port Arthur, Ont., has been elected chairman of the Lakehead Branch of the Institute. A graduate of the University of Toronto, with a B.A.Sc. degree received in 1912, Mr. Flook is from Willowdale, Ont. He is an Ontario land surveyor and a Dominion land surveyor. Mr. Flook worked first as assistant to W. S. Gibson, o.l.s., and from 1913 to 1935 he carried on a private practice as an Ontario land surveyor and civil engineer. During these years he was associated also with C. D. Howe and Company. He received his appointment at Port Arthur in 1935.

. B. Samuel, M.E.I.C., is now the city engineer at Red Deer, lberta. He was formerly employed by the city of Edmonton s field engineer.

. F. Walsh, M.E.I.C., secretary-treasurer of the Sarnia Branch f the Institute, has been named assistant technical controller n charge of utilities, and of the steam and power and butadiene dehydrogenation units of the Polymer Corporation at arnia, Ont. He was previously plant utility engineer for the orporation.

V. F. Jarrett, M.E.I.C., is an electrical engineer in the aluminum conductors division of the Aluminum Company of anada Limited at Shawinigan Falls, Que. He had been at sle Maligne, Que., employed as electrical engineer for the aguenay Power Company Limited.

. A. Monti, JR.E.I.C., who has been assistant professor at Ecole olytechnique, Montreal, while preparing for a Ph.D. degree, vas awarded that degree this summer. He has accepted the ppointment as regional representative of the Technical Inormation Service of the National Research Council at Montreal.

. A. Burgess, JR.E.I.C., formerly of Consolidated Mining and Smelting Company of Canada Ltd., Trail, B.C., is now employed as junior design engineer with A. V. Roe Canada Limited, Malton, Ont.

W. Hardy Craig, JR.E.I.C., formerly construction supervisor for Dow Chemical of Canada Limited, Sarnia, Ont., has accepted employment with Merck & Company, Limited, Montreal.

W. J. Horner, JR.E.I.C., is now employed at Sheldons, Limited, Galt, Ont., as sales engineer. He was formerly with Babcock-Wilcox and Goldie-McCulloch Limited, in that city.

R. W. Moulton, S.E.I.C., is in Hillsborough, N.B., having been appointed plant engineer for the Canadian Gypsum Company there. He graduated with honors in May from the Nova Scotia Technical College, receiving the degree of bachelor of engineering.

Jean Paul Gignac, S.E.I.C., has received the degree of bachelor of applied science from the Ecole Polytechnique, Montreal, and is in the employ of the Dufresne Engineering Company, at Montreal, Que.

R. F. Buckingham, S.E.I.C., is now at St. Johns, Newfoundland, in the employ of the Newfoundland Railway. He graduated this year from Nova Scotia Technical College with a bachelor of engineering degree, civil.

D. B. Mutton, S.E.I.C., and **G. W. Farnell,** S.E.I.C., have been awarded scholarships of the Association of Professional Engineers of Ontario at the University of Toronto. Mr. Mutton has completed his second, and Mr. Farnell his third year in engineering.

L. A. Thornton, M.E.I.C., consulting engineer of Regina, Sask., was elected a director of the South Saskatchewan River Development Association at the first annual meeting of the association held in June last.

E. C. Thorne, M.E.I.C., has entered the foreign trade service of the Department of Trade and Commerce, Export Branch, Ottawa, Ont. He assumed his new responsibilities in the Machinery, Metals and Chemicals section on August 1st.

H. E. Pawson, M.E.I.C., assistant commercial manager of the Power Corporation of Canada Limited, Montreal, has been elected president of the Canadian Electrical Association.

E. D. Gray-Donald, M.E.I.C., chief engineer of the Quebec Power Company, Quebec, is second vice-president of the Canadian Electrical Association for the 1947-48 season.

G. H. Thompson, M.E.I.C., vice-president of Montreal Engineering Company Limited, Montreal, is third vice-president of the Canadian Electrical Association for the 1947-48 season.

J. F. McDougall, M.E.I.C., has been made registrar of the Association of Professional Engineers of Alberta. He is assistant manager and secretary-treasurer of McDougall and Secord Limited in Edmonton.

H. M. Weir, M.E.I.C., assistant city engineer of Saskatoon, Sask., was elected a director of the South Saskatchewan River Development Association at the first annual meeting of the association held in June last.

Lucien Delisle, M.E.I.C., who has been with the Quebec Department of Highways at Waterloo, Que., is now assistant superintendent engineer for the north section of the division of streets of the city of Montreal Department of Public Works.

C. D. MacKintosh, M.E.I.C., recently assumed the position of engineer in charge of the new Nanaimo Terminals being worked by the Esquimalt and Nanaimo Railway Company. He had been division engineer and assistant superintendent for C.P.R. at Victoria, B.C.

D. B. Rees, M.E.I.C., has recently accepted the position of airport maintenance supervisor for the Dominion Government at Ottawa, in charge of maintenance of all airports, aerodromes and intermediate landing fields leased or supervised by the Department of Transport. Before accepting this appointment he was a wing commander, R.C.A.F. in the construction engineering branch. His staff appointment was that of deputy director with administrative control of construction and maintenance units. He was also chairman of a Dominion Government inter-departmental board established to finalize R.C.A.F. cost plus construction contracts in Canada, Newfoundland and Labrador.

Walter L. Rice, M.E.I.C., has resigned from the Works Department of the City of Toronto after twenty-eight years of service. He has joined the engineering staff of the Department of Public Works, Ontario, where he will be employed on the design, construction and maintenance of water supply and sanitary disposal units for the various government institutions in the province.

Obituaries

The sympathy of the Institute is extended to the relatives of those whose passing is recorded here.

William F. Drysdale, M.E.I.C., died in hospital in Montreal on July 4th, 1947. Born at St. Andrews East, Que., in 1881, he attended McGill University, Montreal, receiving a B.Sc. degree with honors in 1904. While studying, he had also followed a special apprenticeship with the Grand Trunk Railway at Pointe St. Charles in Montreal. For seven years after graduation he was with the American Locomotive Company at Schenectady and New York, N.Y., with successive appointments as draughtsman, calculator, cost estimator, assistant to chief engineer, and power engineer. In 1911 he joined the United Fruit Company of Costa Rica, Central America, as superintendent of motive power and mechanical engineer for the Northern Railway of Costa Rica. He was named assistant works manager for the Steel Company of Canada, in 1914, worked on the laying out of high explosives plants in the Montreal District and later went to France in charge of locomotive work for the Montreal Locomotive and American Locomotive Company. From 1919 to 1923 he acted as managing director of Worthington Pump and Machinery interests in many European countries, and in 1923 founded the Brazilian Portland Cement Company in Sao Paulo. In 1932 he was named vice-president of Montreal Locomotive Works Limited.

Mr. Drysdale joined the Department of Munitions and Supply in 1940 and upon the expansion of the Munitions Production Branch he became joint director-general of munitions production. Subsequently he was named director-general of the industrial planning branch. In June 1942 he was named executive assistant to Rt. Hon. C. D. Howe, Minister of Munitions and Supply. In September of that year, he resigned this post to return to the vice-presidency of the locomotive firm. At the time of his death, in addition to that office, he held that of manager of the Post-War Planning Committee, American Locomotive Company, New York. He was awarded the O.B.E. in the Dominion Day Honors List in 1946.

Mr. Drysdale was a member of the Quebec Corporation of Professional Engineers and of the Association of Consulting Engineers. He joined the Institute in 1904 as a Student. He transferred to Associate Member in 1911 and to Member in 1919, and was awarded Life Membership in March 1946.

G. M. Tripp, M.E.I.C., of Victoria, B.C., died at his home on September 9th, 1946. Born at Woodstock, Ont., in 1875, he attended schools in that city.

In 1898, soon after its formation, he joined the B.C. Electric Railway Company, and for 46 years aided in its expansion.

With A. T. Goward, late vice-president and director, he was responsible for the whole programme on Vancouver Island, and acquired a notable knowledge of the waterpower potentialities of that part of the country. Originally all electric power was generated by the small steam plant at Rock Bay, and when this was found inadequate for the needs of growing Victoria, plans were made by Mr. Tripp in 1898 for the building of the Goldstream plant some 12 miles from Victoria. This was the first hydro-electric plant on Vancouver Island, and, in fact, one of the first on the Pacific Coast. Foreseeing the increasing demands for electric power supply, Mr. Tripp undertook in 1908 the Jordan River project, the construction of which plant was considered a great achievement in hydro-electric development. Also under his direction was the construction of the steam plant at Brentwood Bay, near Victoria, in 1912.

Mr. Tripp retired from active work in 1944. He joined the Institute in 1919 as an Associate Member, transferring to Member in 1936, and being awarded Life Membership in January 1946. He joined the Association of Professional Engineers of British Columbia in 1920, and was elected to the Council of the Association in 1925.

S. W. Gray, M.E.I.C., of Halifax, N.S., councillor of the Institute, died on May 13th 1947, after his return home from the Annual Meeting at Toronto.

Born in Westville, N.S., in 1892, he attended the Nova Scotia Technical College, where he was graduated with the degree of B.Sc. in civil engineering in 1914. For two years after graduation he was engaged in railway work in the Maritimes and from 1916 until 1919 was on active military service in Canada, England and France. After some time spent as industrial surveyor with the Department of Soldiers Civil Re-establishment at Halifax, he joined the Nova Scotia Power Commission in 1924 and remained with that organization until his death. From 1942 until early in 1946 he was on leave of absence to act as maritime regional representative of the Wartime Bureau of Technical Personnel, at Halifax.

Mr. Gray joined the Institute as an Associate Member in 1920, becoming a Member in 1920. He served as councillor for the Halifax Branch in 1941-42 and as secretary-treasurer of the Branch for several years. He was president of the Association of Professional Engineers of Nova Scotia and acted as joint secretary of the Association and the Halifax Branch. He served as Councillor of the Institute representing the Association in 1946 and had resumed that office for the 1947 term.

A. W. Sinnamon, M.E.I.C., of Hamilton, Ont., passed away on June 28th, 1947. He was born at Rich Hill, Ireland, in 1871 and studied at the Belfast Technical School, graduating in 1888. He served seven years apprenticeship for Harland and Wolf, and came to Canada in 1901. He worked in the mechanical department of Dominion Iron and Steel Company Limited at Sydney, N.S., from 1902 to 1909, when he went to Toronto, Ont., as chief engineer for Canada Foundry Company Limited. He left that position in 1913 to establish a private practice in Ottawa, Ont., and was later, for six months chief engineer of the Anniston Ordinance Company, Alabama, returning to Montreal to accept the position of mechanical superintendent of Armstrong-Whitworth and Company of Canada, Limited. From 1917 to 1918 Mr. Sinnamon was manager of the Joliette Steel Company, Joliette, Que., and subsequently was engaged in organizing the Terrebonne Electric Power and Steel Company. In 1920 he was appointed superintendent of construction for the Algoma Steel Corporation Limited, at Sault Ste. Marie, Ont. In 1921 he was engaged in private practice, and in 1924 he became mechanical engineer of the Hubbell and Benes Company, Cleveland, Ohio. In 1927 Mr. Sinnamon became works manager for the Van Dorn Iron Works Company in Cleveland, going to the Geometric Stamping Company in that city in 1934 in an executive position. In 1939 he went to Victoria, B.C., to live in retirement but on the outbreak of war he felt the urge to contribute his ability to the war effort. He came back east and held various positions with Foster Wheeler, Hamilton Bridge Company, Atlas Steel Company, Brantford Coach and Body Company, B. Greening Wire Company, Wolverine Engineering Company, L. V. Sullivan Engineering Company.

Mr. Sinnamon joined the Institute as a Member in 1920.

W. S. Lea, M.E.I.C., Montreal consulting engineer, died suddenly on Saturday, July 5th, at his summer residence at Senneville, Que. He was born at Victoria, P.E.I., in 1877, and studied at the Prince of Wales College, Charlottetown, and at McGill University, Montreal. His early engineering experience was with two leading sanitary engineers in Boston, the late Freeman C. Coffin, and the late Frank A. Barbour. While with Mr. Barbour, he was engineer in charge of construction for the Fredericton Filter Plant, the first modern type filter plant built in Canada, and he operated the plant for six months. From 1908 to 1911 he lectured at McGill University in municipal engineering and hydraulics. In 1911-12 he was engineer in charge of the department of waterworks and bridges for the city of Vancouver. In 1913 he entered into partnership with his brother, the late R. S. Lea, M.E.I.C., and together they were consulted on many outstanding projects. The partnership continued until the retirement of R. S. Lea in 1930.

His advice has been sought by municipalities in every province of Canada, as well as by Provincial and Dominion governments and industrial organizations, including pulp and paper firms and power companies. He appeared as an expert before the International Joint Commission on questions of pollution of boundary waters, of water storage and run-off control. He was responsible in large measure for design and construction of large scale sewerage and sewage treatment schemes for Montreal, Winnipeg and Vancouver; for water supply systems or extensions in these cities and in scores of others; and for hydro-electric developments on the Winnipeg River, Lake of the Woods, Coaticook, Pont Rouge and elsewhere. At the time of his death he was consultant to the City of Montreal on the St. Pierre River sewage pumping plant design.

Mr. Lea joined the Institute in 1909 as an Associate Member, transferring to Member in 1913, and being awarded Life Membership in January 1947. He held membership in the Corporation of Professional Engineers of Quebec, the Association of Professional Engineers of Manitoba, the American Society of Civil Engineers, the American Water Works Association, and the McGill Graduates Society.

Dr. John Stephens, M.E.I.C., New Brunswick educator and consulting engineer, died on June 17th, 1947.

Engineer in charge of steam power development for the New Brunswick Electric Power Commission, Dr. Stephens was formerly professor of mechanical engineering at the University of New Brunswick, retiring from that position in 1945 after 37 years of service to the university. He was dean of the faculty of engineering and, in addition, had a wide private practice in the province, being consulting engineer for many projects, notably the Nashwaak Pulp and Paper Company Limited and the New Brunswick Power Commission.

Dr. Stephens was born in 1884 at Clontarf, near Dublin Ireland, and was educated at Trinity College, Dublin, from which he held the degrees of M.A. and M.Eng. In 1927 he was honored by the University of New Brunswick with the degree of D.Sc. in recognition of his long and outstanding work as teacher and leader in his profession.

He came to Canada in 1907 and became assistant professor of engineering at the University, and was professor of mechanical engineering from 1908 to 1916. He went overseas then with the C.E.F. as a lieutenant in the 2nd Siege Battery in France. He also instructed in gunnery in England. Returning to his professorship on demobilization, he was appointed dean of the Faculty of Applied Science in 1921. In 1932 he was appointed to the membership of the National Research Council, Ottawa. In 1940, with the rank of captain, he organized the 2nd 90th Field Battery, R.C.A.

He was a member of the Civil Engineers of Ireland, and a past-president of the Association of Professional Engineers of New Brunswick. He joined the Institute as a Member in 1924

B. E. Bury, M.E.I.C., of Vermilion, Alta., died in hospital on Thursday, June 19th, 1947, following a month's illness.

He was born at Bournemouth, England, and studied at the university of Liverpool. He served two years' apprenticeship with Messrs. C. and A. Musker, Liverpool hydraulic engineers and was later employed in the drawing office of the firm. He went to South America in 1898 and, until 1911, was engaged in railway construction work in Argentina, and irrigation and surveying in Paraguay and Uruguay. Coming to Canada he did engineering work in Ontario, British Columbia and Alberta, and settled in Vermilion in 1926. He has done considerable survey work there and has worked on oil locations since 1939. He drew the plans for the present arena rink surveyed the town for gas pipe lines and water and sewer lines. Two years ago he carried out an extensive re-survey of the town and also surveyed the town of Wainwright for its proposed water and sewer system. He was working on oil locations at Edgerton when he was stricken suddenly with the illness from which he did not recover.

Mr. Bury joined the Institute as an Associate Member in 1922, transferring to Member in 1940.

News of the Branches

Activities of the Twenty-eight Branches of the Institute and abstracts of papers presented

MONTREAL BRANCH

E. M. Van Koughnet, m.e.i.c. - *Secretary-Treasurer*

Of interest to our Montreal members will be the new arrangements now being planned for Opening Night next Fall. One innovation, decided upon by your Executive Committee, will be the holding of the meeting at a hotel rather than at Headquarters. This was decided upon with some reluctance as it was felt that the most fitting place for such a gathering was, of course, our own building. However, the overcrowding which has attended Opening Night for the last several years has greatly detracted from the pleasure of the occasion. Therefore in order to comfortably accommodate all those who wish to come (and it is expected that next Fall's opening will be more widely attended than ever) arrangements have been concluded with the Mount Royal Hotel to hold the meeting in Cardy Hall which provides ample accommodation for four or five hundred. As no Thursday evening was open, the evening of Wednesday, October 1st, was secured.

It is expected that Opening Night will coincide with the President's visit to Montreal so we shall probably have the honor of Col. Grant's company at the meeting.

A programme of activities is being prepared and refreshments are coming in for due consideration. More details on the final arrangements in this column, the September issue of the *Journal*.

Junior Section

This year, more than ever before, the Junior Section is giving special consideration to engineering students by holding a meeting referred to as "Junior Section Student Night", on November 17, 1947. The purpose of this Student Night is to provide an opportunity to students to perfect their public speaking and at the same time give them advance preparation for the Branch Student Night which will be held later, in February.

All student engineers are invited to submit papers, the subject matter to bear on summertime occupational projects, experience or interests. There should be an unlimited variety of subjects resulting from the students' summer work and this will give them a splendid opportunity to report to their fellow students, and also to acquire valuable experience in the preparation of an address for delivery before an audience.

All papers, delivery of which should not take more than 10 minutes, should be in the hands of the Junior Section Vice-Chairman, three weeks prior to Student Night. The four best papers will be selected by the Junior Section Executive Council for delivery at the Student Night. The four winning participants are to be the guests of the Junior Section at the Annual Dance, November 28, 1947.

After the delivery of the papers a leading authority will discuss the preparation and presentation of addresses and the art of speaking effectively.

Do not let all the interesting facts and experiences you have encountered during your summer work be forgotten. Write them up, and send your write-up to the Junior Section Vice-Chairman. The Engineering Institute gives out every year, several prizes for papers of outstanding interest presented at regular meetings and published in the *Journal*. These prizes are open to students and juniors as well; your paper may make you eligible for a prize.

NIAGARA PENINSULA BRANCH

P. A. Pasquet, jr.e.i.c. - - - *Secretary-Treasurer*
C. A. O. Dell, m.e.i.c. - - - *Branch News Editor*

The annual meeting of the Niagara Peninsula Branch was held at Club Henley, just off the Queen Elizabeth Way near St. Catharines, Ontario, on Friday evening, June 13th. Refreshments were served, A. L. McPhail acting as the genial host, after which the members partook of a chicken dinner.

Following the dinner W. D. Brownlee, retiring chairman, made a short valedictory address, in which he called on all members to turn out and hear speakers not only in their own but in all fields of engineering, for their own benefit and also to further the efforts of the executive in securing new speakers. After thanking the members and executive for their support during the year, Mr. Brownlee turned the meeting over to M. F. Ker, chairman for 1947-48.

Councillor P. E. Buss spoke in appreciatien of the work of the retiring chairman in leading the branch through the year, and noted that his successful record could be at least partly attributed to the fact that he had attended 100 per cent of the meetings.

The president of the Institute, Lieutenant-Colonel L. F. Grant, on behalf of the Niagara Peninsula Branch, presented Mr. Brownlee with the gold pin of the Institute as a token of appreciation for his successful leadership of the branch for the past season.

Mr. Ker then introduced the newly-elected branch executive, and also W. D. Laird who, as assistant secretary of the Institute, succeeding Louis Trudel, was making his first visit to a branch.

Mr. Laird spoke briefly, and very ably outlined his aims as assistant secretary and asked for the help of all members in improving the *Journal*. He mentioned that the deadline for mailing the *Journal* should be the 10th of the month and that it was hoped that this deadline might be more nearly met as current printing difficulties were overcome. One of the projects now under way in the headquarters office is the preparation of a manual covering the organization and administration of branches of the Institute.

Mr. W. R. Manock, vice-president of the Institute, introduced President Grant, who touched on several matters that are presently of vital interest to members of the Institute.

He strongly backed up Mr. Brownlee in his plea to the members to hear speakers from all branches of the profession, and pointed out that it is a failing of too many engineers to regard themselves as engineers of a particular kind only, and to close their minds to lectures, books, and various other sources of information which do not pertain to their own particular specialty. This attitude is too narrow, the president said, and we must open our minds to all aspects of engineering. It is very often true that a lecture on a subject with which an individual has no connection whatever is often one which will be of the greatest benefit.

Colonel Grant also touched on the subject of cooperation with the various associations of professional engineers and said that progress was being made toward closer cooperation between the Institute and those bodies. He stated that any lack of cooperation that existed had been largely due to misunderstanding.

The president also spoke of conservation of the natural resources and natural beauty of this country. He pointed out that engineers as a group had failed in the past to lay sufficient stress on this subject and, as a result, our forests have been depleted, top soil washed away by floods, or blown away following drought, and many natural beauty spots have been despoiled by engineering works not suitably fitted into their surroundings.

The president closed on a note of tribute to headquarters staff and invited all members to visit headquarters office whenever possible.

C. Climo, member of the branch executive, thanked the president for his visit, and Chairman M. F. Ker invited all the members to meet the president personally after the meeting.

SAGUENAY BRANCH

J. E. Dyck, m.e.i.c. - - - - *Secretary-Treasurer*

On Monday, June 23, the Saguenay Branch was host to the presidential party which included, besides President and Mrs. L. F. Grant, Vice-president and Mrs. R. S. Eadie, Assistant General Secretary and Mrs. W. D. Laird, Vice-president and Mrs. G. F. Layne, Councillor and Mrs. R. C. Flitton and Councillor and Mrs. J. B. Sterling.

During the day, the party was conducted on an industrial inspection tour of the Arvida Works of the Aluminum Company of Canada Limited and the Shipshaw Power Development. This was followed by a dinner meeting of the Branch in the evening.

In his remarks to the Branch, Colonel Grant dealt chiefly with his work as chairman of the Committee on the Training and Welfare of the Young Engineer, and he acknowledged receipt of suggestions made by the Saguenay Branch, particularly those concerning the undergraduate.

With respect to the problems of the junior engineer, he

Vice-president G. F. Layne and Col. Grant (right) met many of the members informally before dinner.

described some aspects of this work which are being tackled. An effort is being made to pay special attention to the so-called "orphan" engineers who are so located that they are not closely associated with any branch, and to encourage their attendance at meetings whenever possible. Another means being adopted is to assign to the junior member some recognized senior member to act as "guide, philosopher, and friend", and to give him advice on professional problems and development of his engineering career.

Speaking generally of the Institute, Colonel Grant told of his first impressions of it, remarking that his sense of privilege in being associated with outstanding men in the engineering profession and the original feeling of personal inadequacy in belonging to an organization of such outstanding recognition had remained unchanged. The president went on to describe recent experiences which illustrate the esteem in which The Engineering Institute is held in this country and in the United States. He spoke of the modern tendency of engineers to take executive positions or to practice branches of engineering other than those in which they have graduated. Under these circumstances The Engineering Institute offers common ground for association.

Vice-president G. F. Layne spoke briefly, stressing for junior members the fact that they would receive benefits from their association with the Institute only to the extent to which they participate in and support its activities.

Vice-president R. S. Eadie, speaking for the Finance Committee, mentioned the increase in Institute revenues and in branch rebates, resulting from the increase in dues and noted that it has been possible to make the initial rebate for 1947 equal to the total for 1946. He then went on to speak of the programme for increased activities which will be implemented as soon as possible.

Councillor R. C. Flitton stressed the importance to the Institute of the young members, and recommended to the meeting the new Assistant General Secretary W. D. Laird. Mr. Laird confined his remarks mainly to *The Engineering Journal*. He expressed an appreciation of the short-comings of the *Journal* and described the difficulties being encountered. However, he hoped that these would be overcome, and solicited suggestions for improvement of the publication.

Councillor J. B. Stirling spoke of the attitude of the Institue toward the Canadian Council of Professional Engineers and Scientists. He discussed the background which led to the present stand, and then invited questions from the floor.

Past-vice-president McNeely DuBose stressed the importance to the Institute, as a growing organization, of maintaining the interest and support of young engineers.

Chairman F. T. Boutilier expressed the appreciation of the Branch to the members of the presidential party, before closing the meeting.

A "President's-eye view" from the head table.

Library Notes

Book notes, Additions to the Library of The Engineering Institute, Reviews of New Books and Publications

REVIEWS

BULLETIN OF THE ATOMIC SCIENTISTS

Members of the Institute will be interested in knowing about a publication which although now in its third year of publication is still not widely known. It is the *Bulletin of the Atomic Scientists,* the mouthpiece of a group known as The Atomic Scientists of Chicago. It is largely supported by a grant from the Emergency Committee of Atomic Scientists of which Albert Einstein is chairman.

The publication is for the layman. It is part of the scientist's effort to inform the people and arouse them to the point that they will demand that something be done about the control of war in general and of the awful power of the atom, in particular. These are objectives that should appeal to all normal citizens.

In the June issue the leading editorial gives the keynote for the interest of the scientist and the common man. It says:

"If there is something we cannot afford in dealing with atomic energy, it is muddled thinking, policy based on ignorance, hearsay, prejudice, partisan expediency or wishful thinking. The justification for the intrusion of scientists into national and international affairs, is the compelling necessity for a factual, realistic attitude as a basis of political decisions of our statesmen and political thinking of our citizens."

The first article in the same issue is by Harold C. Urey, professor of chemistry at the University of Chicago—a Nobel Prize winner and a member of the Institute for Nuclear Studies. The following two paragraphs which are not contiguous in the article are quoted as indicating the extremes of what has occurred in the United States. The first one speaks of early success and the second one of later failure:

"In the latter part of 1945 the Atomic Scientists stated publicly and vigorously that there was no satisfactory solution to the problem of the atomic bomb except world control of atomic energy in all its phases. They brought this view to the attention of the people of the United States and to our government leaders in Washington, and they have done all they can to bring this point of view to the attention of people in other countries. Their efforts were highly successful, and largely due to them, a very unusual and enlightened proposal for the control of atomic energy was placed before the Atomic Energy Commission of the United Nations in the form of the Baruch proposals, which were to a large extent the proposals of the Acheson-Lilienthal Committee."

"As scientists we have engaged in an experiment in international political control of the atomic bomb, and today it seems to me that we should realize that that experiment is a failure. That is my conclusion, and it has been my conclusion for some time. Moreover, I believe the time is growıg short and that alternative proposals and actions should e undertaken at once."

The *Bulletin* is an "authoritative unbiased publication on he subject of atomic energy and its political and economic nplications." It is of particular interest to those who are oncerned about the possibilities of the future in relationhip to this new source of energy and to the maintenance f peace.

Other articles in the June issue are listed herewith as they vill give *Journal* readers some idea of the field and purposes f this publication:

An Alternative Course for the Control of Atomic Energy.
With the Atomic Bomb Casualty Commission in Japan.
A Japanese Scientist Describes the Destruction of his Cyclotrons.
How the American People Feel about the Atomic Bomb.
War Department Thinking on the Atomic Bomb.
The World Government Movement in the United States.
The Senate Debates Mr. Lilienthal's Confirmation.
Books
UN Atomic Energy News.

(*Bulletin of the Atomic Scientists,* 1126 East 59th St., Chicago, Ill. $2.00 per year.)

CURRENT WATERWORKS PRACTICE

A PRACTICAL TREATISE OF THE PROVISION OF WATER SUPPLIES FOR URBAN AND RURAL COMMUNITIES

V. H. Maxwell, London, Batsford, 1946, 254 pp., 9 x 6 in., cloth, 18/-.

Reviewed by William Storrie, M.E.I.C.*

The author reviews in considerable detail the effect of the war on British water supplies and the long overdue maintenance and extensions to the systems.

The book consists of 15 chapters, 4 appendices, 19 plates and numerous diagrams to illustrate the text.

Probably the most interesting chapter deals with the effect of aerial warfare upon the designs of waterworks structures in which is given a long list of the best protective measures to be used under varying conditions.

A study of the British practice indicates how clearly the Canadian methods follow more closely those adopted in the United States. This is particularly so in the use of reinforced concrete for dams. Reference is made to a number of dams constructed in the United States and Canada.

Detailed reference is made to the establishment of a comprehensive National Water Policy. The book sets out in detail the British practice adopted in waterworks systems and brings up to date the latest developments in water supply practice.

Consulting Engineer, Gore and Storrie, Toronto, Ont.

OIL BURNER SERVICE MANUAL

Kalman Steiner & Fred Ravnsbeck, N.Y., McGraw-Hill; Toronto Embassy, 1942, 365 pp., illus., 5½ x 8½", cloth, $5.65.

Reviewed by H. M. Esdaile, M.E.I.C.*

This book describes domestic and industrial oil burners and auxiliary equipment broadly, and with sufficient explanations to give the reader a good idea of the various types and their proper application. The authors succeeded in their obvious attempt at making the descriptions as complete as possible.

The book was written to give the oil burner dealer and his mechanical staff the information basic to the installing and servicing of oil burning equipment. However, as it would be almost impossible to cover the complete installation and servicing details for all oil burner apparatus in a single text, the individual manufacturers' instruction books and drawings must also be consulted.

Superintendent, Service & Erection Department, Combustion Engineering Corporation, Montreal.

ADDITIONS TO THE LIBRARY

TECHNICAL BOOKS, ETC.

Audel's Oil Burner Guide; Installing, Servicing, Repairing:
Frank D. Graham. N.Y., Audel, c1947. 364 pp., illus., cloth.

Carbon, Graphite, and Metal-graphite Brushes:
National Carbon Co. (c1946). 115 pp., illus., cloth.

Crane Library Manual:
Research and Development Laboratories; Library Manual of Procedures. Chic., Crane, 1947. Mimeographed.

Detour; the Story of Oflag IVC:
Lieut. J. E. R. Wood (ed.). London, Falcon, 1946. 183 pp., illus., cloth.

Essentials of Applied Physics; A Foundation Course for Technical, Industrial, and Engineering Students:
Royal M. Frye. N.Y., Prentice-Hall, 1947. 322 pp., illus., cloth.

Heat Pumps:
Philip Sporn, E. R. Ambrose, Theodore Baumeister. N.Y., Wiley, 1947. 188 pp., illus., cloth.

Materials of Industry; their Distribution and Production; 4th ed.:
Samuel Foster Mersereau; rev. by Calvin G. Reen and Kenneth L. Holderman. N.Y., McGraw-Hill (c1947). 623 pp., illus., cloth.

Modern Polishes and Specialities; Raw Materials and Manufacturing Methods:
W. D. John. Brooklyn, Chemical Publishing Co., 1947. 313 pp., cloth.

Powder Metallurgy; Principles and Methods:
Dr. Henry H. Hausner. Brooklyn, Chemical Publishing Co. (c1947). 307 pp., illus., cloth.

Reclaimed Rubber; the Story of an American Raw Material:
J. M. Ball. N.Y., Rubber Reclaimers Assoc., 1947. 248 pp., illus., cloth.

S.A.E. Handbook; 1947 ed.:
N.Y., Society of Automotive Engineers, Inc., c1947. 822 pp., illus., cloth.

Varnished Cloths for Electrical Insulation:
H. W. Chatfield and J. H. Wredden. Brooklyn, Chemical Publishing Co., 1947. 233 pp., illus., cloth.

Writing the Technical Report; 2nd ed.:
J. Raleigh Nelson. N.Y., McGraw-Hill, 1947. 388 pp., cloth.

PROCEEDINGS, TRANSACTIONS, ANNUALS, ETC.

American Institute of Electrical Engineers:
Transactions, Volume 65, 1946.

American Society of Mechanical Engineers:
Transactions, Volume 68, 1946.

Canadian Trade Index; Annual Issue of 1947:
Toronto, Canadian Manufacturers' Assoc., c1947.

Engineering College Research Council of the American Society for Engineering Education:
Directory of Member Institutions and Review of Current Research. Iowa City, Iowa, Engineering College Research Council, 1947.

Kungl. Tekniska Hogskolans, Handlingar. (Royal Institute of Technology, Stockholm, Sweden).
Transactions; Nr 8, 1947—Automatic Impedance Meter, by Hans Werthen and Bjorn Nilsson.

Institution of Naval Architects:
Transactions, Volume 88, 1948.

TECHNICAL BULLETINS, ETC.

Bell Telephone System. Technical Publications. Monographs:
B-1401—Vicalloy—a Workable Alloy for Permanent Magnets, E. A. Nesbitt. B-1415—Technical Aspects of Visible Speech.

Edison Electric Institute:
Boilers and Combustion 1946. (Publication No. O-13, 1947).—Cable Operation, 1944 (Publication No. O-14).

Electrochemical Society—Preprints:
91-34-A—Electric Activation of Chemical Reactions, William J. Cotton—91-34-B—op. cit., II, Critical Reaction Frequencies—91-34-C—op. cit., III, Critical Electrode Frequencies—91-34-D—op. cit., IV, Critical Wave Length Tables—91-34-E—op. cit., IVa, Critical Frequency Tables—91-34-F—op. cit., V, Multiple Activation.—91-34-C—op. cit., VI, Periodic Activation and Work Functions of Electrode Materials.

Princeton University, Industrial Relations Section:

Selected References, no. 16, July, 1947: Wage Levels.

Quebec (prov.). Department of Mines:

Geological Reports: *28—Wetetnagami River Area: Ralleau, Effiat, and Carpiquet Townships County of Abitibi East, by H. W. Fairbairn, 1946.—29—Wetetnagami Lake Map—Area: Souart, Moquin, Labrie Townships Abitibi—East County, by R. Bruce Graham, 1947.*

Statens Kommitte for Byggnadsforskning, Stockholm. Meddelanden:

Nr 8, 1947—Buckling of Webs in Deep Steel I Girders; a Report of and Investigation, by Georg Waslund ond Sten G. A. Bergman.

U.S. Geological Survey:

Bulletin: *951—Geology of the Green River Desert—Cataract Canyon Region, Emery, Wayne, and Garfield Counties, Utah—Pt. 2—Mops: Green River Desert—Cotaroct Conyon Region, Utah.*

...Water Supply Papers: *915—Mojor Winter and Nonwinter Floods in Selected Basins in New York and Pennsylvania.—No. 993—Geology and Ground—Woter Resources of Cedar City and Parowon Valleys, Iron County, Utah.—No. 996—Geologic Features of the Connecticut Valley, Moss., as Related to Recent Floods.*

STANDARDS, SPECIFICATIONS, ETC.

American Institute of Electrical Engineers. Specifications:

AIEE No. 1, June 1947—Introduction to AIEE Standards; General Principles upon which Temperature Limits are Based in the Rating of Electric Machines and Apparotus. AIEE No. 40, July 1947—Standord for Electric Recording Instruments. AIEE No. 700, July, 1947—Standord for Aircraft Direct-Current Apparatus Voltoge Ratings.

American Society for Testing Materials; 1946 Book of ASTM Standards including Tentatives:

Part 1-A—Ferrous Metals.—Part 1-B—Non-ferrous Metals.—Part II—Nonmetallic Moterials—Constructional.—Part III-A—Nonmetallic Materials—Fuels, Petroleum, Aromotic Hydrocarbons, Soaps, Water, Textiles.—Part III-B—Nonmetallic moteriols—Electrical Insulation, Plostics, Rubber, Shipping Containers, Paper, Adhesives.

Canadian Standards Association. Specification:

CSA B-75-1947—Code of Proctice for the Use ond Core of Chain.

U.S. National Bureau of Standards:

Report of the thirty-second National Conference on Weights ond Measures (Miscellaneous publicotion M186).

PAMPHLETS, ETC.

Accomplishments and Prospects:

H. H. Hewetson. Sarnia, Imperial Oil Limited, April 28, 1947.

Aircraft Builders; an account of British Aircraft Production, 1935-1945:

Lond., HMSO, (1947).

Bibliography of Relay Literature, 1927-1939:

N.Y., American Institute of Electricol Engineers, 1941.

Building Code for Smaller Municipalities:

Ottawa, National Research Council of Canada, 1947. (NRC No. 1536) (Based on the National Building Code and the Model Zoning By-law).

Calculating Machines; Recent and Prospective Developments:

D. R. Hartree. Cambridge, University Press, 1947.

Canada. Parliament. House of Commons:

Bill 338—Act to Provide for the Investigation, Conciliation ond Settlement of Industrial Disputes. Ottawa, 1947.

Chemical Consultant and your Business:

N.Y., Foster D. Snell, Inc., (1947).

Comparison between the Coverages of AM and FM Broadcasting:

J. B. Knox. Montreal, RCA Victor.

Engineering Statistics; Basic Ideas on the Subject as it is applied in Production Control and Standardization:

G. W. Stubbings, Manchester, Emmott, (1947), (Mechanical World Monographs, 38).

Hidden Hazards; a Guide to Help you Make your Home Safer Through the Selection of Proper Materials and Proven Methods of Construction:

Philadelphia, Insurance Company of North America (c1946).

Housing in Canada; a Factual Summary:

Central Mortgage and Housing Corporation, Economic Research Division, Vol. 2, No. 2. Ottawa, 1947.

List of Periodicals abstracted by Chemical Abstracts with Key to Library Files and Other Information:

Ohio State University, Columbus, Ohio, American Chemical Society, 1946.

Manual on Collective Bargaining for Professional Employees:

Part I—National Labor Relations Act and Professional Employees, N.Y., Engineers Joint Council (c1947).

ENGINEERS JOINT COUNCIL

Photogrammetric Control Extension:

Ralph O. Anderson. (Supplementary to Applied Photogrammetry), Chattanooga, Tenn., 1947.

Transmission Line Fault Locator (Report No. PRA-135, unclassified):

Wilfred G. Hoyle. Ottawa, Laboratories of the National Research Council of Canada. Electrical Engineering and Radio Branch, 1946.

Upper Energy Limit of the K^{40} Beta-Ray Spectrum:

W. J. Henderson Ottawa, National Research Council, 1947

What does Top Management Require of an Employee Relations Department?:

H. H. Hewetson (Presented at the Fifth Annual Conference, The Personnel Association of Toronto). Toronto, 1947.

BOOK NOTES

The Institute does not assume responsibility for any statements made; these are taken from the preface or the text of the book.

Prepared by the Library of The Engineering Institute of Canada

British Standards Specification for Nomenclature of Commercial Timbers Including Botanical Names and Sources of Supply. B.S. 881 & 589: 1946:

London, British Standards Institution, 1946. 7/6—.

The two standards B.S. 589 for softwoods and B.S. 881 for hardwoods, have been reissued in this new combined and revised edition. The grades of hardwoods and softwoods refer to the botanical group to which the timber belongs and not to the physical properties.

Information about the botanical species, sources of supply, and other commercial or botanical names by which the timber may have been known is given. There is a comprehensive index for both the standard and botanical names which enables any timber to be readily traced.

The following book notes appear here through the courtesy of the Engineering Societies Library of New York. The books may be consulted at the Institute Library.

A.S.T.M. STANDARDS including Tentatives, 1946. 5 Vols.
Part I-A—Ferrous Metals, 1181 pp.
Part I-B—Non-ferrous Metals, 917 pp.
Part II—Nonmetollic Materials—Constructional, 1762 pp.

NOTICE

Bank, Foreign Exchange, and Postage Charges are not included in the prices listed. Members are therefore requested to await receipt of invoice before forwarding remittance in payment of publications ordered through the Institute Library.

Part III-A—Nonmetallic Materials—Coal and Coke, Petroleum Products, Aromatic Hydrocarbons, Soaps, Waters, Textiles, Gaseous Fuels, 1290 pp.

Part III-B—Nonmetallic Materials—Electrical Insulating Materials, Plastics, Rubber, Paper, Shipping Containers, Adhesives, 1360 pp.

American Society for Testing Materials, Philadelphia, Pa., 1947. illus., diagrs., charts, tables, 9¼ x 6 in., cloth, Parts IA, IB, IIIA, or IIIB, $8.00 each; Part II, $12.00; complete set of All Five Parts, $44.00.

Now covering more than 1400 specifications, tests, etc., this new combined edition contains all of the standards, adopted and tentative, as of the present date. In order to accommodate the increased number of items the present edition is in five volumes instead of three, as follows: the metals volume is split in two parts—ferrous and non-ferrous; the nonmetallic constructional materials remain in one volume; the other nonmetallic materials are in two volumes—one covering fuels, petroleum products and textiles and the other covering plastics, rubber, paper, adhesives, and electrical insulation. These volumes may be bought separately.

AUDELS OIL BURNER GUIDE:

F. D. Graham. Theodore Audel & Co., New York. 364 pp., illus., diagrs., charts, tables, 6½ x 4¾ in., cloth, $1.00.

The purpose of this book is to provide a source for an understanding and a practical working knowledge of the theory, construction, installation, operation, testing, servicing, and repair of all types of oil burners, domestic and industrial. The book is profusely illustrated, with additional help in the form of electrical hook ups (wiring diagrams) of all automatic control systems. A considerable part of the text is in question and answer form.

S A E HANDBOOK 1947 Edition:

Society of Automotive Engineers, New York, N.Y. 822 pp., illus., diagrs., charts, tables, 8¼ x 5½ in., fabrikoid, $5.00 to members, $10.00 to non-members.

This standard reference work contains all current SAE Standards and Recommended Practices of the Society, except those specifically for aeronautical use which are, however, listed and identified. Among the new standards in this edition are those for hydraulic brake fluids, involute serrations, automotive steel castings, low alloy, high tensile steel specifications, and mountings for license plates. Current new data on crankcase oil types, copper and silver brazing alloys, and arc welding electrodes are published as General Information.

SHOT PEENING:

American Wheelabrator & Equipment Corp., (formerly American Foundry Equipment Co.), Mishawaka, Indiana, 1946, 2nd ed. illus., diagrs., charts, tables, 9 x 6 in., paper, $1.50.

The first part of this book is devoted to a discussion of the applications and advantages of shot peening and the equipment and procedures involved. The second part covers the theory of prestressed surfaces in relation to shot peening. Brief reference lists accompany the chapters of Part I, while Part II contains a fairly extensive bibliography. The book is well illustrated.

SOCIAL SECURITY: SELECTED LIST OF REFERENCES ON UNEMPLOYMENT, OLD AGE AND SURVIVORS, AND HEALTH INSURANCE, 1947, REV. ED.

Princeton University, Industrial Relations Section, Dept. of Economics and Social Institutions, Princeton, N.J. 60 pp., 8¾ x 6 in., paper, $0.75.

In this bibliography, the Industrial Relations Section presents, for the third time since 1936, its selections of the most valuable material currently available in the field of social security. Economic rather than administrative aspects are emphasized. The entries are broadly classified and have brief annotations.

Although not available in the Institute Library, inquiries concerning the following new books will be welcomed there or may be sent direct to the publishers.

ANTENNAE, an Introduction to Their Theory:

J. Aharoni. Clarendon Press, Oxford, England; Oxford University Press, New York, Toronto, 1946. 265 pp., diagrs., charts, tables, 9½ x 6 in., cloth, $8.50.

The object of an antenna theory is the evaluation of the electromagnetic field produced by a given system of generators and conductors or, concisely, the determination of the type of antenna required to produce a specified field distribution. This book gives a comprehensive account of the mathematical developments in calculating these aspects of the properties of antennae. The three sections deal respectively with boundary-value problems, antennae and integral equations, and antennae as wave guides.

APPLIED MATHEMATICS for ENGINEERS and PHYSICISTS:

L. A. Pipes. McGraw-Hill Book Co., New York and London, 1946. 618 pp., diagrs., charts, tables, 9 x 5¾ in., cloth, $5.50.

This text covers those topics of higher mathematics (series, differential equations, matrices, special functions, vector analysis, etc.) which form the essential mathematical equipment of a scientific engineer or a physicist. The material dealt with is general in nature and includes the fields of electrical, mechanical, and civil engineering as well as the mathematics of classical physics. The mathematics of mechanical and electrical oscillations, electrical field theory, modern operational calculus, nonlinear oscillations, and potential field theory is clearly set forth. References accompany each chapter.

CASEY JONES CYCLOPEDIA of AVIATION TERMS:

Compiled and arranged by H. L. Williams in cooperation with the staff of the Academy of Aeronautics, La Guardia Field, New York, under the supervision of Aviation Research Associates. McGraw-Hill Book Co., New York and London, 1946. 246 pp., illus., diagrs., charts, tables, 12 x 8¾ in., cloth, $5.00.

This cyclopedic dictionary supplies detailed descriptions and definitions in non-technical terms. The items are arranged in classified sections with an alphabetical index to the whole work. Extensively illustrated, the classified arrangement allows the inclusion of plates with the several sections showing the relation of certain items to other parts of the same structure or condition. All words and phrases have been included on a basis of a specific application to aeronautics.

COMMUNICATION THROUGH the AGES, from Sign Language to Television:

A. Still. Murray Hill Books, New York and Toronto, 1946. 201 pp., illus., diagrs., 8½ x 5½ in., cloth, $2.75.

From tribal drums and smoke signals to radiotelephony and television the author traces the development of the art and science of communication. In addition to the accepted and scientifically valid methods discussed, there are also interesting sidelights on various supposed or projected methods varying from the unsanctioned to the supernatural, with a final brief discussion of telepathy. Footnote references point to further reading on many topics.

DRAKE'S CYCLOPEDIA of RADIO and ELECTRONICS, a Reference and Instruction Book:

H. P. Manly and L. O. Gorder. 12th ed. Frederick J. Drake & Co., Chicago, 1946. No pagination, illus., diagrs., charts, tables, 9 x 5¾ in., cloth, $6.00.

The definitions or descriptions in this practical volume range from single lines to several pages of text depending on the simplicity or complexity of the topic. Mathematical explanations have been held to the necessary minimum, but free use has been made of illustrative sketches and diagrams. Considerably revised throughout, the major additions of new material are in the fields of hyper frequencies or microwaves, in industrial electronics, and in the material on tubes.

ELECTRIC DISCHARGE LAMPS. (Monographs on Electrical Engineering, Vol. XII.)

H. Cotton, Chapman & Hall, London, 1946. 435 pp., illus., diagrs., charts, tables, 8¾ x 5½ in., cloth, 36s.

The structure of atoms and molecules is explained in sufficient detail for an understanding of the fundamental principles involved in light production in discharge lamps. Descriptions are given of the various kinds of lamps in present use, with their construction and operating characteristics. The control of electric discharge lamps is discussed, and a chapter is devoted to the nature of fluorescence and the applications of fluorescent materials to these lamps.

ELEMENTS OF MINING:

G. J. Young. 4th ed. McGraw-Hill Book Co., New York and London, 1946. 755 pp., illus., diagrs., charts, tables, 9 x 5¾ in., cloth, $6.50.

This comprehensive treatment of mining practice emphasizes fundamental engineering principles and covers cost analyses, examples of cost, and dimensional data established by practice. The text is restricted to underground methods of mining unstratified mineral deposits, both coal and metal, with necessary references to open pit and alluvial mining. The present edition has been revised to conform with current conditions, particularly with regard to developments in mechanical equipment and explosives. *(Continued on page 407)*

PRELIMINARY NOTICE

of Applications for Admission and for Transfer

August 1st, 1947

The By-laws provide that the Council of the Institute shall approve, classify and elect candidates to membership and transfer from one grade of membership to a higher.

It is also provided that there shall be issued to all corporate members a list of the new applicants for admission and for transfer, containing a concise statement of the record of each applicant and the names of his references.

In order that the Council may determine justly the eligibility of each candidate, every member is asked to read carefully the list submitted herewith and to report promptly to the Secretary any facts which may affect the classification and selection of any of the candidates. In cases where the professional career of an applicant is known to any member, such member is specially invited to make a definite recommendation as to the proper classification of the candidate.*

If to your knowledge facts exist which are derogatory to the personal reputation of any applicant, they should be promptly communicated

Communications relating to applicants are considered by the Council as strictly confidential.

The Council will consider the applications herein described at the September meeting.

L. Austin Wright, General Secretary

*The professional requirements are as follows:—

A **Member** shall have been engaged in some branch of engineering for at least six years, which period may include apprenticeship or pupilage in a qualified engineer's office or a term of instruction in a school of engineering recognized by the council. In every case a candidate for election shall have held a position of professionl responsibility for at least two years. The occupancy of a chair as professor, assistant professor, associate professor or lecturer in a faculty of applied science or engineering, shall be considered as professional responsibility.

Every candidate who has not graduated from a school of engineering recognized by the council shall be required to pass an examination as prescribed by council, on the theory and practice of engineering, with special reference to the branch of engineering in which he has been engaged.

A **Junior** shall have been engaged in some branch of engineering for at least four years. This period may be reduced to one year, if the candidate for election has graduated from a school of engineering recognized by the council, in which case he shall not remain in the class of Junior beyond the end of the eighth year after graduation.

Every candidate who has not passed the examinations of the third year in a school of engineering recognized by council shall be required to pass an examination in engineering science as prescribed by council. He shall not remain in the class of Junior beyond age thirty.

A Junior may be transferred to Member without payment of transfer fee providing he makes application before the end of the seventh year after graduation or, if a non-graduate, before attaining age twenty-nine, and his application is approved by council.

Council may extend the above limits if in its opinion special circumstances warrant such extension.

A **Student** shall be at least seventeen years of age, and shall present a certificate of having passed an examination equivalent to the final examination of a high school, or the matriculation of an arts or science course in a school of engineering recognized by the council or shall be required to write examinations as prescribed by the council.

He shall be:

a. pursuing a course of instruction in a school of engineering recognized by the council, in which case he shall be transferred to Junior automatically without payment of transfer fee in the second January after graduation, or

b. receiving a practical training in the profession in which case he shall be transferred to Junior without payment of transfer fee providing he makes application before attaining age twenty-five and his application is approved by council.

He shall not remain in the class of Student after he has attained the age of twenty-five, unless in the opinion of council special circumstances warrant the extension of this age limit.

An **Affiliate** shall be one who is not an engineer by profession but whose pursuits, scientific attainments or practlal experience qualify him to cooperate with engineers in the advancement of professional knowledge.

The fact that candidates give the names of certain members as reference does not necessarily mean that their applications are endorsed by such members.

FOR ADMISSION

BARDSLEY—JOHN ALBERT, of Montreal, Que. Born at Manchester, England, Nov. 3, 1890. Educ.: Manchester Tech. School, Eng., 1905-09; 1905-09, jr. & jr. dftsman., Homan & Rodgers; 1910-12, dftsman., asst. works engr., Stratford Iron Works; 1912-14, dftsman., flour milling, Co-op. Wholesale Society; 1914-22, asst. chief dftsman., outside supvr., Robinson & Karshaw (all foregoing, ind. work, mech. and structl.); Wayagamack Pulp & Paper Co., as follows: 1922-25, chief dftsman., Three Rivers, 1925-31, plant engr., 1931-33, chief plant engr., (Consolidated Paper Corp., Wayagamack Divn.) 1933-37, divn. engr., while with above engaged in plant mtce., design and layout, etc., of all additions and alterations inclu. complete two machine news mills, unloading wharf, etc.; with Australian Paper Mfrs., Melbourne, as follows: 1937-39, chief design and constrn. engr., 1939-42, res. dist. mgr and engr. when mill was built and operating, 1942-45, design and planning engr. for post war extensions to all A.P.M. mills; 1946 (10 mos.), res. engr. on constrn. of new mill and planning future extensions to mill, Wabasso Cotton Co., Grand'Mere, Que.; at present, asst. to chief engr., design and layout of chemical recovery at two mills and layout of Lignin plant, Howard Smith Paper Mills, Montreal, Que.

References: F. Bradshaw, A. A. Wickenden, H. G. Timmis, E. Butler, J. T. Lakin, H. Sorgius, J. A. Michaud, A. D. Ross.

BEWS—KENNETH FARNCOMBE, of Arnprior, Ont. Born at Trenton, Ont., April 21, 1908. Educ.: B.Sc. (Mech. Engrg.), Queen's, 1934; R.P.E., Ontario; 1934-36, mech. engr. i/c new constrn., Nichols Chemical Co., Sulphide, Ont.; with Canadian International Paper Co., as follows: 1936-39, dftsman., then sr. dftsman, Gatineau, 1940-42, war sub-contract engr., 1932-45, mill engr., 1946, asst. plant engr., Three Rivers, Que.; 1946 to date, plant engr., Kenwood Mills Ltd., Arnprior, Ont.

References: C. G. Biesenthal, D. S. Ellis, R. M. Prendergast, A. N. Ball, R. A. Low, A. Jackson.

BROOKS—PHILIP GERRY, of Hamilton, Ont. Born at Indian Head, Sask., May 20, 1920. Educ.: B.Sc. (Chem. Engrg.), Saskatchewan, 1943; 1943-45, asst. chemist, British American Oil Co., Ltd., Moose Jaw, Sask.; 1945-47, supvr., Canadian Resins & Chemicals Ltd., Shawinigan Falls, Que., at present, supvr., Irvington Varnish & Insulator Co., Hamilton, Ont.

References: R. A. Spencer.

CUNNINGHAM—JAMES BAKER, of Kingston, Ont. Born at Hammond, Indiana, May 14, 1912. Educ.: B.Sc. (Mech. Engrg.), 1934; MSc. (Fuel Engrg.), 1935, Virginia Polytechnic Institute, Blacksburg, Va. (accredited E.C.P.D.); 1935-37, dftsman., design of chemical process equipt., bldg. layouts, etc., Tennessee Eastman Corp., Kingsport, Tenn.; 1937-42, calculator, designs calculations for all details and assemblies of steam locomotives, Lima Locomotive Works, Lima, Ohio; 1942-43, U.S. Army; 1944-45, chief, rail engrg. branch, supply div., Transportation Corps, U.S. Army, responsible for design of all U.S. Army procured steam locomotives; 1945-47, calculating engr., design of all details, assemblies and complete units of all types of steam locomotives; at present, mech. engr., responsible for engrg. connected with design and bldg. of locomotives, Canadian Locomotive Co., Kingston, Ont.

References: W. Casey, P. Roy, L. F. Grant, H. Conn.

DUNDAS—KENNETH BROOKE, of Medicine Hat, Alta. Born at Pelly, Sask., Aug. 21, 1913. Educ.: B. Eng. (Civil), Saskatchewan, 1940; 1939 (6 mos), instru'man, Prince Albert National Park, Sask.; with Canadian Pacific Railway Co., as follows: 1944-45, transitman, Penticton, 1945-46, transitman, Revelstoke, 1946 to date, transitman or asst. to div. engr., Medicine Hat, Alta.

References: K. A. Truman, D. A. Livingston, H. R. Younger, R. A. Spencer, I. M. Fraser.

FISCH—GERALD GERHARD, of Moose Jaw, Sask. Born at Heidelberg, Germany, April 19, 1922. Educ.: B.Sc. (Agriculture), McGill, 1944; 1941 (summer), develop't technologist, Cerophyl Laboratories Ltd.; 1942 (summer), chief cost control checker, Libby, McNeil & Libby; 1943 (summer), student chem. engr. and shift supvr., Calvert Distillers; 1944-46, consultg. engr., wool divn., research and develop't, soap divn., chemist, process develop't, leather divn., Canada Packers Ltd., Toronto, Ont.; 1946:47, plant chem. engr. and chief chemist, Western Chemurgy Ltd.,Moose Jaw, Sask.; at present, engr. i/c process and equipt. develop't., Saskatchewan Minerals, Chaplin, Sask.

References: C. M. Thompson, A. A. Holland.

IVORY—THOMAS HENRY, of Toronto, Ont. Born at Dundalk, Ont., April 27, 1924. Educ.: B.A.Sc. (Civil), Toronto, 1946; with Canadian Pacific Railway Co., as follows: 1945 (summer), jr. transitman, Union Station, Toronto, 1946-47 (6 mos.), st. transitman, supervised repairs of concrete trestle bridge, genl. track layout work, soundings and genl. field work, Bruce division; 1947 (Feb.), to date, jr. engr. and designer, assted. in design of retaining wall, culverts and bridge structures, railway and bridge section, Dept. of Works, City of Toronto, Ont.

References: A. U. Sanderson, J. F. MacLaren, W. S. Wilson, M. W. Huggins, C. F. Morrison.

KRZEMIENIEWSKI—JOZEF, of Montreal, Que. Born at Warsaw, Poland, March 10, 1909. Educ.: M.Sc., (Chem. Engrg), Lwow Univ., (Poland), 1931; 1932-34, asst. lecturer, Lwow Univ.; Ordnance Factory, No. 1, Fort Bema, Warsaw, as follows: 1934:37, chief analytical chemist, 1937-39, chief research chemist; 1940, research chemist, Etablissement Ruggieri, St. Denis, France; 1940-43, supt. amm. filling dept., British Manufacture & Research Co. Ltd., Grantham, Lincs., Eng.; 1943-45, prod. mgr., Sandoz Products Ltd., Bradford, Yorks., Eng.; 1946-47, explosives chemist, Greenwood & Batley Ltd., Farnham, Yorks., Eng., and at present with Robert A. Rankin Co., Ltd., Montreal, Que.

References: J. S. Korwin Gosiewski, B. Szczeniowski, A. F. Grant, G. Burdett, A. R. Cromwell.

MARES—WILLIAM JOSEPH, of Montreal, Que. Born at Hull, England, March 17, 1890. Educ.: Certificate of Proficiency in Engrg. Science, Glasgow University, 1913; Member, Inst. Naval Architects; Member, Soc. Naval Architects and Marine Engrs, U.S.A.; 1905-12, apprent. Barclay Curle & Co., Glasgow; 1911-12-13, winter sessions at Glasgow Univ.; 1913-15, charge hand shipdftsman., Alex. Stephen & Sons, Linthouse; 1915-17, sr. shipdftsman., Scotts Shipbldg. & Engrg. Co., Ltd.; 1917-18, temporary asst. constructor, Royal Corps of Naval Constructors, London; 1919-23, chief dftsman. and naval arch. Dublin Dockyard Co. Ltd., Dublin; 1923-24, i/c Haulbowline Dockyard, Queenstown, office of Public Works; 1924-37, genl. mgr., Vickers (Ireland) Ltd., Dublin; 1938-39, naval arch., responsible for layout new shipyard at Gydnia, Poland, and design of vessels constructed there; 1939-42, temporary constructor, Royal Corps of Naval Constructors on staff Warship Prod. Supt., Liverpool; 1942-46, naval arch., Wartime Shipbldg. Ltd., Canada, constrn. mgr. for company and controlled central drawing office in Montreal; 1946-47, shipmanager, engaged on reconversion "Queen Mary", John Brown & Co., Ltd., and at present, mgr. for Geo. A. Sharp, naval arch., Montreal, Que.

References: C. L. Dewar, R. S. Eadie, T. R. McLagan, F. P. Shearwood, G. H. Midgley, G. O. Vogan, G. Agar, R. M. Robertson.

PINN—PHILIP WILLIAM, of Port Arthur, Ont. Born at Gladstone, Man., July 25, 1908. Educ.: B.Sc. (Elect.), Manitoba, 1932; 1932-34, rodman, chainman, Manitoba Dept. Public Works; 1934-39, not engaged in engrg.; 1939-41, designer, civil, elect. and mech. on steam power and constrn., elect. dist. system plant, bldgs., etc., 1941-42, elect. foreman, Granby Consolidated Mining & Smelting and Power Co. at Princeton and Copper Mountain, B.C.; 1943-46, R.C.E.M.E. (overseas) with rank of Lieut.; 1946 to date, elect. engr., design of power and lighting systems in grain elevators, ind. plants, etc., C. D. Howe Co., Limited, Port Arthur, Ont.

References: J. N. McNeil, H. M. Olsson, W. C. Byers, D. W. Laird. H. Os.

ROGERS—CECIL GORDON, of Trail, B.C. Born at Victoria, B.C., Jan. 5, 1916. Educ.: B.A.Sc. (Civil), British Columbia, 1943; 1944, instructor, Survey Wing, R.C.A.; 1945, surveyor, permanent bridges, R.C.E. (overseas), 2nd Battalion; 1946, surveys engr., Dept. Mines and Resources, Ottawa, Ont.; at present, engr. on mtce. cost control engrg. divn., Consolidated Mining & Smelting Co. of Canada, Ltd., Trail, B.C.

References: E. M. Stiles, E. Mason, C. E. Marlatt, E. B. Broadhurst, A. C. Ridgers, J. N. Finlayson, J. V. Rogers.

SAUNDERS—GEORGE OATEN, of Kingston, Ont. Born at Sudbury, Ont., May 10, 1908. Educ. B.Sc. (Mech. Engrg.), Queen's, 1941; R.P.E., Ontario; 1940-41, inspectr. i/c Pt. St. Charles Work, genl. mtce. plant elect. and mech. equipt., Canada Car & Foundry for British Air Commission; 1942 to date, asst. mtce. engr., Canadian Locomotive Co., Limited, Kingston, Ont.

References: W. Casey, P. Roy, A. Jackson, H. Conn.

SHORTER—GORDON WILLIAM ERSKINE, of Ottawa, Ont. Born at Ottawa, Ont., May 23, 1918. Educ.: B.A.Sc. (Mech.), Toronto, 1947; R.P.E., Ontario; 1939-41, prod. engrg. asst., Ottawa Car and Aircraft; 1941-45, Tech. Officer, R.C.N.V.R., attached to mechanical section of Directorate, interpreting British drawings to Canadian standard for materials, substitutions and dimensional tolerances, supvrn. of mfg. of specialized equipt. in such plants as C.P.R. (Angus Shops), Dominion Engrg., Montreal, General Steel Wares, Toronto; at end of period assumed charge of instrument section, dealing with engrg., mfg. and testing of precision type instruments at Ferranti Electric (Ordnance Divn.), Sangamo, etc., work entailed discussions with plant engrs. on various engrg. problems encountered in mfg. of such equipt.; 1946 (summer), paper tester, E. B. Eddy Co.; at present, member of firm, A. E. Shorter & Sons, hardware, Ottawa, Ont.

References: K. M. Cameron, C. R. Young, T. R. Loudon.

SNELGROVE—WILLIAM HENRY, of Montreal, Que. Born at Toronto, Ont., Dec. 30, 1915. Educ.: B.Eng. (Mech.), McGill, 1938; R.P.E., Quebec; 1938-39, mill mtce., master mech. dept., Consolidated Paper; 1939-40, final inspecn. plant fabricated equipment., Wabi Iron Works, engrg. dept.; with R.C.A.F., as follows: 1941-42, Engr. Officer i/c mtce., 1942-43, Squadron Engr. Officer, England, Chief Tech. Officer, 1943-45, 2nd Tactical Air Force R.C.A.F. Overseas; 1945 to date, prod. mgr. i/c of engrg., Pepsi-Cola Co. of Canada, Ltd., Montreal, Que.

References: C. M. McKergow, D. C. MacCallum, H. K. Morris, R. F. Shaw, M. L. Sherwood, W. O. Horwood, G. L. Archambault.

SUTHERLAND—WILLIAM COLLIE, of Halifax, N.S. Born at New Waterford, N.S., Nov. 30, 1909. Educ.: B.Sc. (Elect. Engrg.), Nova Scotia Tech., 1933; 1933-36, various engrg. jobs, chaining, instrument work; 1936-39, elect. hoisting engr., operation and mtce. of hoist and compressor, Acadia Coal Co.; with R.C.E., as follows: 1941-43, supervn. engineer training personnel, Petawawa, Ont., 1943-44, supervn. engr. training, England, 1944-45, 2nd in Command, 18th Cdn. Fd. Coy., Holland and Germany, 1945 to date, Works Officer, Camps and Defences, 6 Works Coy., R.C.E., Halifax, N.S.

References: P. C. Ahern, A. J. Bernard, C. A. Anderson, P. A. Lovett, R. Kendall, S. L. Henley.

TOUCHETTE—LOUIS, of Port Alfred, Que. Born at L'Ange Gardien, Que., Oct. 27, 1918. Educ.: Mech. Engrg., I.C.S., 1942; B.A. (Science Divn.), Laval Univ.; 1939-40, dftsman., Saguenay Power Co., Ltd.; 1940-41, mech. dftsman., Aluminum Co. of Canada, Ltd., Arvida, Que.; 1942, mech. dftsman., Price Bros. & Co. Ltd., Riverbend, Que.; 1943-1945, mech. dftsman., piping layouts, genl. arrangements of machinery, mech. instlns., foundation drawings, etc., Aluminum Co. of Canada, Ltd., Arvida, Que.; 1945 (5 mos.), on loan to D.I.L. and C-I-L at Montreal, on secret projects, designing machinery, genl. layouts for Chalk River pump house; 1945 to date, designer and chief dftsman., assisting plant engr., calculations, estimates, checking drawings, investigations and reports, planning work for dftsman., esc., i/c dftsmen. and surveying dept., Consolidated Paper Corporation Ltd., Port Alfred, Que.

References: C. H. Jette, G. Deneau, K. A. Brebner, G. C. Reinhardt, H. R. Fee, E. T. Buchanan.

YOUNG—STEPHEN M., of Hamilton, Ont. Born at Saskatoon, Sask., June 11, 1912. Educ.: B.Eng., 1933; M.Sc. (Mech. Engrg.), 1935, Saskatchewan; R.P.E., Ontario; with International Harvester Company, as follows: 1935-41, product engr., engrg. dept., 1941-44, asst. chief engr., 1944 to date, chief engr., Hamilton, Ont.

References: A. A. Scarlett, W. J. W. Reid, L. A. Sentance, H. O. Peeling, N. B. Hutcheon.

LIBRARY NOTES

(Continued from page 405)

PORTLAND CEMENT TECHNOLOGY:

J. C. Witt. Chemical Publishing Co., Brooklyn, N.Y., 1947. 518 pp., illus., diagrs., charts, maps, tables, 8¾ x 5½ in., cloth, $10.00.

The manufacture of portland cement is dealt with comprehensively from the selection of the raw materials to the analysis and testing of the finished product. The necessary processes are discussed in detail, including the mechanical equipment, power and fuel requirements, output and cost figures, storing and shipping. Three chapters are devoted to concrete materials and concrete technology. A broadly-classified 30-page bibliography is appended.

Production and Properties of PLASTICS:

S. L. Kaye. International Textbook Co., Scranton, Pa., 1947. 612 pp., illus., diagrs., charts, tables, 9¼ x 6 in., cloth, $5.00.

Presenting a complete survey of the field, the author discusses the various types of plastics, the selection of raw materials, treatment processes, design of molds, application of heat and pressure, and finishing operations in the production of plastic articles. Inspection, testing methods, and practical applications are described, and the author has included numerous shop hints and procedures from practical experience. There is also a chapter on cost estimates for plastic articles.

SPECIFICATIONS and TESTS for ELECTRODEPOSITED METALLIC COATINGS:

Sponsored by American Society for Testing Materials and American Electroplaters' Society, November 1946. American Society for Testing Materials, Philadelphia, Pa. 46 pp., diagrs., charts, tables, 9 x 6 in., paper, $1.25 (to A.S.T.M. and A.E.S. members, $.95).

Seven specifications for electrodeposited coatings and two test methods are brought together in this publication for convenient reference. All have been prepared jointly with the American Electroplaters' Society with the exception of the salt spray test. Also included are two recommended practices for chromium plating on steel and the preparation of low-carbon steel for electroplating.

ANNOUNCEMENT

The University of Michigan School of Public Health is offering an Inservice Training Course in Garbage and Refuse Collection and Disposal for public works officials, October 27 and 28, 1947. Printed programs will be ready for distribution about September 1st, and interested persons should address correspondence to The University of Michigan, School of Public Health, 109 South Observatory Street, Ann Arbor, Michigan.

Employment Service

The service is operated for the benefit of members of The Engineering Institute of Canada, and for industrial and other organizations employing technically trained men—without charge to either party. It would therefore be particularly appreciated if employers would make the fullest possible use of these facilities to make known their existing or estimated requirements. Notices appearing in the Situations Wanted column will be discontinued after three insertions, and will be re-inserted upon request after a lapse of one month. Personal interviews by appointment.

Situations Vacant

CIVIL

CIVIL ENGINEERS required in Montreal for design of reinforced concrete. Must be experienced. Salary $300-$400. Apply to File No. 3892-V.

CIVIL ENGINEER required by a firm in the St. Maurice Valley, to be in charge of improvements in woods operations such as dams, bridges, roads, etc. Must be bilingual. Salary $350. Apply to File No. 3902-V.

MECHANICAL

GRADUATE MECHANICAL ENGINEERS for Sessional appointment as Instructors for 8 months from 1st September, 1947, and Demonstrators for 7 months from 1st October, 1947, required by McGill University. Apply giving qualifications and salary required to File No. 3600-V (I).

MECHANICAL ENGINEER, bilingual, with 4 or 5 years experience in sheet metal work, required as Plant Manager by a manufacturer in the Province of Quebec. Salary open. Apply to File No. 3894-V.

MECHANICAL ENGINEER required by a firm of Power House and Building Specialists to act as representative in the Toronto Territory. Must be familiar with that district. Preferably manufacturers' agent to act as sub-agent. Salary open. Apply to File No. 3897-V.

MECHANICAL DRAUGHTSMAN with at least 5 years' experience or graduate just out of college, to act as draughtsman on industrial work. Salary above $200. Group insurance plan. Apply to File No. 3899-V.

GRADUATE MECHANICAL ENGINEER, 3 years, experience, preferably in industrial layout, required by consulting engineering office in Montreal to serve as junior engineer on design of industrial project. Salary about $250. Group insurance plan. Apply to File No. 3899-V.

MECHANICAL ENGINEER required for the purchasing and material control departments of an industrial organization in Montreal. Salary $300 up. Apply to File No. 3900-V.

RECENT GRADUATE, mechanical background, required by a manufacturer in Montreal for duties leading to production. Salary $225. Apply to File No. 3901-V.

ELECTRICAL

SEVERAL EXPERIENCED ELECTRICAL DRAUGHTSMEN for the design and layout of industrial power and control system, required by consulting engineering office in Montreal. Salary open. Good chance for advancement. Apply to File No. 3890-V.

GRADUATE ELECTRICAL ENGINEER, 3 to 5 years, experience, preferably in industrial electric power applications and electric control, required by consulting engineering office in Montreal, to act as assistant to the electrical engineer on design of a large industrial project.. Salary open Apply to File No. 3890-V.

JUNIOR ELECTRICAL ENGINEER, required as assistant to Plant Manager of a textile manufacturing concern near Montreal. Salary $250 to $300. Apply to File No. 3903-V.

JUNIOR ELECTRICAL ENGINEER with practical experience in general manufacturing industries required by an industrial organization in Ontario. Salary open. Apply to File No. 3904-V.

ELECTRICAL ENGINEER, recent graduate, required by an industrial organization in Montreal. Salary $200 up. Apply to File No. 3905-V.

ELECTRICAL ENGINEER, recent graduate, required by a paper company for work in mill equipment and power generators. Salary $225. Apply to File No. 3906-V.

MISCELLANEOUS

MECHANICAL, CHEMICAL OR CIVIL, recent graduate up, required for sales and service in Alberta by a Montreal manufacturer. Salary open. Apply to File No. 3867-V.

SALES ENGINEERS, required by established Canadian manufacturer of fabricated steel products. Some construction experience an advantage. Wanted for Maritimes, Ontario and Manitoba. Salary open. Apply to File No. 3883-V.

GRADUATE ENGINEER, familiar with industrial processes, metallurgical and chemical engineering as applied to steel, copper, mining and chemical plants. Broad general experience in estimating and designing. Salary open. Toronto area. Apply to File No. 3886-V.

SALES ENGINEER, with electrical engineering background required by an old established firm in Western Ontario for the sale of industrial furnaces and ovens. Splendid opportunity with rapid advancement. Reply giving age and complete details of past experience. Salary open. Apply to File No. 3888-V.

INDUSTRIAL ENGINEER, preferably with mechanical background and several years' experience in time-studies, estimating, etc., required by a manufacturer in Montreal. Salary $250. up according to experience. Apply to File No. 3893-V.

INDUSTRIAL ENGINEER, preferably mechanical or electrical background, required in factory in Montreal for time-study, cost control, etc. Salary $300. up. Apply to File No. 3895-V.

STRUCTURAL ENGINEER, preferably a graduate civil engineer, with experience in the design of mill buildings, required by a paper manufacturer in Eastern Ontario. Salary open. Apply to File No. 3896-V.

SALES ENGINEER, mechanical background, preferably with experience in the refrigeration field, required by a Montreal firm. Salary $250-$300. Considerable travelling. Apply to File No. 3898-V.

WELL-ESTABLISHED FIRM of consulting engineers in Montreal offers position with possibilities to self-reliant man capable of designing and checking all kinds of reinforced concrete and structural steel. Hydro-electric experience an advantage. Must be experienced draughtsman. Pay commensurate with ability. Group insurance plan. Apply to File No. 3899-V.

GRADUATE ENGINEER, with considerable experience required by an industrial organization in Montreal as buyer of mill supplies and plant equipment. Salary up to $5000. depending on experience. Apply to File No. 3900-V.

RECENT GRADUATES, required by an industrial organization in Montreal for training in Purchasing department. Salary $200 up. Apply to File No. 3900-V.

RECENT GRADUATES in Electrical or Mechanical Engineering can still be offered the opportunity of being trained by large Hydro Electric Utility. Very good opportunities for regular employment in various departments at the completion of training period. Minimum salary 1st year $200; 2nd year $215. Apply to File No. 3912-V.

The following advertisements are reprinted from last month's Journal, having not yet been filled.

CHEMICAL

CHEMICAL ENGINEER OR CHEMIST, preferably with Ph.D., required by a pulp and paper company with plants in Eastern Canada, for research work. Salary open. Apply to File No. 3549-V.

CHEMICAL ENGINEER required by a pulp and paper company with plants in Eastern Canada, for mill control and pilot plant work. Salary open. Apply to File No. 3549-V.

CHEMICAL ENGINEER to be assigned to mill process problems for the technical department of a pulp and paper firm in the St. Maurice Valley. Salary $250. up. Apply to File No. 3573-V.

CHEMICAL ENGINEER required as assistant professor of chemical engineering in a Canadian university to start autumn 1947. Salary open. Apply to File No. 3600-V (D)

CHEMICAL OR METALLURGICAL ENGINEERS, from recent graduates up, required by a Quebec firm engaged in metal production for employment as production and development engineers. Salaries open. Apply to File No. 3693-V.

CHEMICAL ENGINEER required for the control department of a paper mill in Shawinigan Falls. Salary from $250-$350. Apply to File No. 3765-V.

CHEMICAL ENGINEER OR CHEMIST interested in textile dyeing, required by an industrial firm in South Western Quebec. Salary open. Apply to File No. 3798-V

CHEMICAL ENGINEER, required by a chemical firm in Shawinigan Falls, Quebec, for development work on plastics. Salary open. Apply to File No. 3812-V.

CHEMICAL METALLURGIST with background in extraction metallurgy and ore dressing (knowledge of minerogy desirable) and experience in use of petrographic microscope. Maximum Salary $4,000. Apply to File No. 3865-V.

CIVIL

CIVIL ENGINEER to take charge of work in a drainage district in Quebec. Must be bilingual. May be recent graduate. Salary from $200. Apply to File No. 3479-V.

CIVIL ENGINEER for design work in an industrial plant in the Montreal area with experience in building construction, probably permanent position, salary from $200 up according to experience. Apply File No. 3504-V.

CIVIL ENGINEERS with experience in detailing and designing structural steel and reinforced concrete for manufacturers are required for a steel fabricating company in Manitoba. Salary open. Apply File No. 3519-V.

CIVIL ENGINEERS, recent graduate up, required by a pulp and paper company with plants in Eastern Canada. Salary open. Apply to File No. 3549-V.

CIVIL ENGINEER, age 35-40, with extensive experience in detailing and checking structural steel in buildings and bridges, required by a steel fabricating company in Southern Ontario. Salary open. Apply to File No. 3570-V

GRADUATE CIVIL ENGINEER, required by a public utility in the Montreal area with three or four years' experience in design of reinforced concrete and structural steel. Salary $250-$300. Apply to File No. 3766-V.

GRADUATE CIVIL ENGINEER required by an industrial corporation in Montreal for design work in draughting room. Must be familiar with structural steel and concrete design. Position offers good opportunity and permanency to right man. Salary from $250 up according to experience. Apply to File No. 3785-V.

SEVERAL CIVIL ENGINEERS, with two or three years' experience in road construction required for road building work in Northern Quebec. Salary open. Apply to File No. 3804-V.

CIVIL ENGINEERS with some experience in design and field work required by a public utility in Toronto. Salary open. Apply to File No. 3813-V.

CIVIL ENGINEER, age 35-40, with considerable experience in design of structures, water supply, sewers, required by an organization in Montreal. Salary $300-$400. Apply to File No. 3820-V.

CIVIL ENGINEER with building construction experience required by a manufacturer in Montreal. Salary $250 up. Apply to File No. 3858-V.

CIVIL ENGINEER required by Town of Pointe Claire, bilingual, minimum five years experience in municipal work, capable of preparing tenders, specifications and drawings, water and sewer systems. Salary open. Apply to File No. 3863-V.

CIVIL ENGINEERS AND DRAUGHTSMEN required by an industrial organization for design and detailing of reinforced concrete for Hydro Electric developments. Location Montreal. Salary open. Apply to File No. 3864-V.

CIVIL ENGINEER required by Eastern Canadian City to supervise construction and maintenance of streets in capacity of City Engineer. Salary open. Apply to File No. 3869-V.

CIVIL ENGINEER, recent graduate, must be bilingual, required for public utility in Quebec City. Salary open. Apply to File No. 3878-V.

CIVIL ENGINEER required as Manager for City of Ste. Therese, Que.. Salary open. Apply to File No. 3881-V.

CIVIL ENGINEERS required as draughtsman in bridge department of large transport company. Preferably with experience in steel ,concrete and timber construction. Location Montreal. Salary $200-300. Apply to File No. 3884-V.

ELECTRICAL

ELECTRICAL ENGINEER, age 32-36, with electrical experience around mines or smelters. English speaking with working knowledge of French, is required by a company in Shawinigan Falls, Quebec. Salary open. Apply to File No. 3415-V.

ELECTRICAL ENGINEER age 30 - 45 with sales training with large manufacturer of electrical equipment instruments and 5-10 years experience as sales service and sales engineer required as sales engineer in Canada for U.S. firm making special equipment for transport and industry. Salary open. Apply to File No. 3447-V.

ELECTRICAL ENGINEER, recent graduate, required for the engineering staff of a paper mill in the Lake St. John area. Salary open. Apply to File No. 3507-V.

INSTRUCTOR IN ELECTRICAL ENGINEERING required for supervision of laboratory classes in power laboratory also few lectures per week, in direct current theory for Canadian University. Salary open. Apply to File No. 3600-V (G).

ELECTRICAL ENGINEER with knowledge of power apparatus, preferably bilingual, required for sales work with a manufacturer in the Montreal area. Salary open. Apply to File No. 3646-V.

ELECTRICAL ENGINEER with considerable industrial experience required as a safety engineer by a public utility in the Montreal area. Bilingual preferred. Salary open. Apply to File No. 3654-V.

ELECTRICAL ENGINEER with several years experience required as a designer by an industrial organization in Montreal. Salary open. Apply to File No. 3677-V.

ELECTRICAL ENGINEER, with general knowledge of a.c. and d.c. motors, switchgear, mercury rectifiers, transformers and other electrical apparatus, for sales work in Eastern Canada, age 30 to 35, salary open. Apply to File No. 3695-V.

ELECTRICAL DRAUGHTSMAN with several years' experience in industrial layouts for large concern in Eastern Townships. Permanent position and attractive salary available for experienced men. Apply to File No. 3701-V.

ELECTRICAL ENGINEER, age about 30, with considerable experience, required by a manufacturer in the St. Maurice Valley. Salary open. Apply to File No. 3723-V.

ELECTRICAL ENGINEER, required by an insurance company, preferably with a few years practical experience, for the inspection of boilers, steam plant and allied equipment in Montreal area. Salary open. Apply to File No. 3754-V.

ELECTRICAL ENGINEER, recent graduate up, required by a manufacturer in Montreal, for sales engineering. Preferably bilingual and familiar with rotating electrical equipment. Salary $200. up. Apply to File No. 3761-V.

GRADUATE ELECTRICAL ENGINEERS with 3 to 10 years experience in design, operation, layout of substations, switching stations, and electrical machinery, together with engineering studies, including draughting for a large hydro electric power house in Quebec. Salary $225 up. Apply to File No. 3787-V.

ELECTRICAL ENGINEER required for power sales by an electrical utility in Province of Quebec. Preferably experienced. Bilingual. Salary open. Apply to File No. 3802-V.

ELECTRICAL ENGINEER with experience in layout and design of generating and transformer stations, required by a public utility in Toronto. Salary open. Apply to File No. 3813-V.

JUNIOR ELECTRICAL ENGINEER required by a Montreal firm for inspection of electrical equipment of all kinds, in Toronto area. Salary $225. Apply to File No. 3816-V.

ELECTRICAL DESIGNING DRAUGHTSMAN with broad practical experience and theoretical knowledge required for a firm in Quebec. Salary from $225. Apply to File No. 3818-V.

ELECTRICAL ENGINEER, recent graduate up, preferably with experience in audio circuits design and maintenance also practical knowledge of fractional horsepower motors and wiring layouts, required to eventually take charge of sound maintenance for motion picture studio in Ontario. Salary open. Apply to File No. 3826-V.

DESIGNING ELECTRICAL DRAUGHTSMAN, preferably with experience on station design and layout required in Montreal, by a pulp and paper mill. Salary open. Apply to File No. 3873-V.

ELECTRICAL ENGINEER under 30, required as sales engineer of switchgear, electrical and power-house equipment, by a manufacturer in Montreal. Considerable travelling. Salary $4,000. plus expenses. Apply to File No. 3885-V.

MECHANICAL

MECHANICAL ENGINEER, is required for draughting and detail work with a company in central Ontario. Good prospects for advancement. Single man preferred. Salary open. Apply to File No. 3393-V.

MECHANICAL ENGINEERS, preferably with design experience, are required for armament research and development in the Quebec area, in a government establishment. Salary from $190. Apply to File No. 3401-V.

MECHANICAL ENGINEER with experience in pulp and paper or mining work required by a pulp and paper company with plants in Eastern Canada. Salary open. Apply to File No. 3549-V.

MECHANICAL ENGINEER with experience in the fabrication of Farm Implements, required by a Quebec firm. Bilingual man preferred. Salary according to experience. Apply to File No. 3666-V.

MECHANICAL ENGINEER with design experience in the pulp and paper industry required by a firm in the St. Maurice Valley. Salary $350. Apply to File No. 3673-V.

JUNIOR MECHANICAL ENGINEER with knowledge of precision machine shop practice and aptitude for research work in metals and plastics required for an organization in Toronto for the production of artificial limbs. Must be veteran. Salary from $225. Apply to File No. 3675-V.

MECHANICAL ENGINEER with industrial or construction experience, required by a firm of consulting engineers to inspect machinery deliveries in the Cornwall area. Salary open. Apply to File No. 3691-V.

MECHANICAL ENGINEERS, with at least five years' experience in the Pulp and Paper industry required by an Ontario Paper Company. Salary open. Apply to File No. 3733-V.

MECHANICAL ENGINEER with experience in heating, ventilating and air-conditioning, required by a consulting engineer in Montreal. Salary open. Apply to File No. 3773-V.

MECHANICAL ENGINEER, with paper mill or mining experience required for design and layout by a paper mill in Northern Quebec. Salary $375-400. Apply to File No. 3778-V.

MECHANICAL ENGINEER with considerable experience willing to act as assistant to Mechanical Superintendent of a textile manufacturing concern near Montreal. Salary open. Apply to File No. 3784-V.

MECHANICAL ENGINEERS required by a Pulp and Paper mill at Powell River, B.C. Preferably with experience in plant design in the pulp and paper industry. Salary according to qualifications. Apply to File No. 3796-V.

MECHANICAL DRAUGHTSMAN, with several years experience in machine design, required by an industrial organization in Montreal. Salary $250 up. Apply to File No. 3807-V.

MECHANICAL ENGINEER with at least 10 years experience in design and installation of machinery also supervisory ability required by an industrial organization in Montreal, Salary open. Apply to File No. 3807-V.

MECHANICAL ENGINEERS, with experience in plant layout and design or ventilation problems or general mechanical design, required by a firm in Quebec. Salary from $250. Apply to File No. 3818-V.

MECHANICAL ENGINEER required as assistant to vice-president and general manager of a medium sized company in Central Ontario. Experience in paper converting would be helpful. Prospects are excellent and salary open. Apply to File No. 3819-V.

MECHANICAL ENGINEER, age 35-40, with considerable experience in design and layout of machinery and equipment, required by an organization in Montreal. Salary $300-$400. Apply to File No. 3820-V.

MECHANICAL ENGINEERS, preferably with experience in machine design, required by a steel fabricating firm in Montreal for design and layout. Salary open. Apply to File No. 3824-V.

MECHANICAL ENGINEER with considerable experience, required to supervise installation of coating machine also design necessary, tankage and piping systems, for a paper mill in Ontario. Salary around $400. Apply to File No. 3828-V.

MECHANICAL ENGINEERS, required by a pulp and paper mill in Ontario for design and layout also mechanical installations. Salary around $300. Apply to File No. 3828-V.

MECHANICAL ENGINEER, required by a manufacturer in Ontario for the plant operation staff. Salary open. Apply to File No. 3833-V.

MECHANICAL ENGINEER with six to ten years experience in maintenance and engineering work, required by alkali manufacturers in Ontario. Salary open. Apply to File No. 3833-V.

MECHANICAL ENGINEER, recent graduate up, veteran preferred must be bilingual. Required to under study Manager and eventually take charge of four plants at St. John. Salary around $200 to start. Apply to File No. 3842-V.

MECHANICAL ENGINEER, recent graduate up, required by a company in Montreal for toll design. Salary $175 up. Apply to File No. 3843-V.

MECHANICAL ENGINEER recent graduate, preferably with some practical experience in manufacturing, required by a Farm Equipment manufacturer in Ontario. Starting salary $225. Apply to File No. 3851-V.

MECHANICAL ENGINEER, recent graduate, required by a paper mill in Northern Quebec. Salary $250. Apply to File No. 3852-V.

MECHANICAL ENGINEER, preferably with experience in heating and ventilating problems required in Montreal for design and investigation. Salary $250 up. Apply to File No. 3858-V.

MECHANICAL ENGINEER, with knowledge of physical metallurgy heat treatment., ability in stress analysis and design. Maximum salary $4,000. Apply to File No. 3865-V.

MECHANICAL ENGINEER, recent graduate, required by a Montreal wallpaper manufacturer to be trained as mechanical superintendent. Salary $200. Apply to File No. 3876-V.

METALLURGICAL

METALLURGIST, with at least 2 years foundry experience, required by a Montreal manufacturer to take charge of foundry practice and annealing. Salary open. Apply to File No. 3853-V.

MINING

MINING ENGINEERS, with varied experience required by a firm in Quebec for general mine operation, exploitation and development work. Salary from $250. Apply to File No. 3818-V.

MISCELLANEOUS

MANAGEMENT ENGINEER with business administration and mechanical background, age 30 up, bilingual with at least 5 years practical experience, required by an industrial engineering consultant in Montreal. Apply to File No. 3307-V.

STRUCTURAL STEEL DRAUGHTSMEN AND CHECKERS, preferably graduate engineers but any experienced men acceptable, are required for a steel fabricating company in Manitoba. Salary open. Apply to File No. 3519-V.

ASSISTANT PLANT ENGINEER with paper mill experience required by a pulp and paper company with plants in Eastern Canada. Salary open. Apply to File No. 3549-V.

GRADUATE ENGINEERS, recent graduates up, preferably with pulp and paper experience, required by a pulp and paper firm in the St. Maurice Valley, to work under Chief Engineer and Senior Designer on long range modern projects. Salary $3,000 up. Apply to File No. 3573-V.

GRADUATE ENGINEERS, required by a large industrial and chemical organization with headquarters in Montreal for all phases of research design, operation, development, production and maintenance. Salaries open. Apply to File No. 3588-V.

PROFESSOR in machine design, required for fall term by a university in Central Ontario. Salary open. Apply to File No. 3600-V (F).

CHIEF ENGINEER with industrial experience required for a steel fabricating plant in Western Canada. Salary open. Apply to File No. 3616-V.

DESIGN DRAUGHTSMAN for the design of cranes and hoists of all types, capable of making and checking complete manufacturing detail drawing, required by a manufacturer in Southern Ontario. Apply to File No. 3628-V by letter with full details. Salary open.

SALES ENGINEER with wide engineering experience wanted by a company in Toronto for the sale of textile machinery and construction equipment. Salary open. Apply to File No. 3639-V.

STRUCTURAL DESIGNERS AND DRAUGHTSMEN required by a firm of consulting engineers in Montreal. Salary open. Apply to File No. 3668-V.

JUNIOR ENGINEERS, recent graduates up, as designing draughtsmen for a brewing company with headquarters in Montreal. Salary from $200. Apply to File No. 3670-V.

JUNIOR ENGINEERS, recent graduate up, required for the engineering staff of a communications company with headquarters in Montreal. Veterans preferred. Salary from $175. Apply to File No. 3713-V.

MINING AND METALLURGICAL ENGINEER, age about 30, with considerable experience, required by a manufacturer in the St. Maurice Valley. Salary open. Apply to File No. 3723-V.

CIVIL ENGINEERS AND ASSISTANT HYDRAULIC ENGINEERS required for government organization on West Coast for highway and construction. Salary open. Apply to File No. 3724-V.

CONSTRUCTION ENGINEER with considerable experience required for the permanent staff of a Montreal inspection company. Salary about $200. Age immaterial. Apply to File No. 3728-V

DETAILER AND DESIGNER for reinforcing steel with considerable experience required by a steel fabricating firm in Montreal. Salary open. Apply to File No. 3740-V.

STRUCTURAL STEEL DETAILER AND CHECKER with considerable experience required for checking shop details by a steel fabricating firm in Montreal. Salary open. Apply to File No. 3740-V.

GRADUATE ENGINEERS, recent graduates up, preferably mechanical, required for the engineering and operating staff of a pulp mill in Eastern Quebec. Salary open. Apply to File No. 3748-V.

PUBLICITY ENGINEER required by an electrical firm in Montreal to organize publicity department and edit trade journal. Salary open. Apply to File No. 3751-V.

TECHNICAL GRADUATE, preferably Mechanical, Chemical or Electrical, under 30, veteran preferred, for permanent position with engineering organization. Training period in U.S. Work will include travelling for consultation among leading industrial plants. Enclose photo when answering. Salary open. Apply to File No. 3759-V.

CIVIL, MECHANICAL OR CHEMICAL ENGINEERS, recent graduates up, preferably with experience in petroleum and heavy industry such as chemical or paper, required by an oil company in Toronto. Salary open. Apply to File No. 3762-V.

BRIDGE ENGINEER, qualified to be in charge of the design and supervision of the construction of highway bridges. Apply stating qualifications, experience, age and salary wanted to File No. 3780-V.

GRADUATE CIVIL OR MECHANICAL ENGINEERS with 3 to 10 years experience in design, cost estimates, draughting, and engineering studies for a large hydro-electric power house in Quebec. Salary $225 up. Apply to File No. 3787-V.

STEAM PLANT ENGINEER for large concern in Eastern Townships, with at least 5 years practical experience. Must be familiar with thermo-dynamics, combustion control, steam turbines, mechanical refrigeration, hydraulics, etc. Permanent position and attractive salary for the right man. Apply to File No. 3791-V.

RECENT GRADUATES OR JUNIOR ENGINEERS with mechanical background, required by a Montreal Engineering, fabricating and contracting firm for training purposes leading to sales and service. Area Montreal. Salary $175 up. Apply to File No. 3810-V.

STRUCTURAL ENGINEER, required by a firm of consulting engineers in Montreal for design work. Must have experience in structural steel and reinforced concrete. Salary open. Apply to File No. 3811-V.

INDUSTRIAL ENGINEER with broad experience in plant development, operation, costs and management required for a firm in Quebec. Salary from $250. Apply to File No. 3818-V.

GRADUATE ENGINEER, preferably with chemical and industrial experience, required to supervise operations at the Sodium Sulphate Plant now being constructed at Chaplin, Sask. Salary open. Apply to File No. 3821-V.

DRAUGHTSMEN required by a pulp and paper mill in the Eastern Townships for general draughting and detailing. Three or four years experience preferred but not essential. Salary open. Apply to File No. 3823-V.

DRAUGHTSMAN, preferably with mechanical background, required by a manufacturer in Montreal for design work on electrical equipment. Salary open. Apply to File No. 3829-V.

DEPUTY DIRECTOR OF IRRIGATION, Ceylon, must be Corporate Member of the Institute of Civil Engineers or possess degrees or diplomas recognized by that body. Technical duties include designing, estimating for and reporting on schemes of irrigation water supply and flood protection and checking the construction costs of such schemes. Apply to File No. 3834-V.

GRADUATE ENGINEER, age 35-40, with 10 years experience in building construction and general contracting work; to supervise design, construction and maintenance of structures for Public Utility in Toronto. Permanent job. Salary open. Send photo and full particulars of education and experience. Apply to File No. 3847-V.

MAINTENANCE SUPERINTENDENT required by an industrial organization in Montreal to supervise the maintenance of wharves, buildings, conveyors, ships, loading and discharging equipment at Port Alfred docks. Salary $350 up. Apply to File No. 3848-V.

JUNIOR INDUSTRIAL ENGINEER, with mechanical or chemical background, preferably with knowledge of chemical plants, required in Montreal. Salary $250 up. Apply to File No. 3857-V.

DRAUGHTSMEN of the following classes: Architectural, piping layout, equipment layout, mechanical design, steam plant, heating, and ventilating, electrical and plumbing required by an industrial organization in Montreal. Salaries open. Apply to File No. 3860-V.

SALES ENGINEER, preferably with mining or mechanical background, practical experience in heavy machinery industry, shovels, cranes, etc., required by an Asbestos company in Montreal. Salary $275-$325. Apply to File No. 3870-V.

RECENT GRADUATE required by a Montreal firm handling pumps, valves, automatic controls, etc., for training leading to sales. Salary $175. Apply to File No. 3871-V.

CIVIL OR MINING ENGINEER, with executive ability, required by a construction firm in Quebec to supervise highway construction. Must be bilingual. Permanent position. Salary $300-500. Apply to File No. 3877-V.

MECHANICAL OR CHEMICAL ENGINEER, recent graduate, required by a firm in Montreal. Ability to do simple drawings, such as layout of piping and instruments. Some experience in oil refinery or chemical plant or pulp and paper would be useful. Position to eventually lead to sales. Salary $200. Apply to File No. 3879-V.

GRADUATE ENGINEERS, required for all phases of research design, operation and development by an industrial organization in Montreal. Salaries open. Apply to File No. 3882-V.

UNIVERSITY OF TORONTO
REQUIRES
Engineer Instructors

Instructors of various grades up to and including lecturer are required by the Faculty of Applied Science and Engineering of the University of Toronto for duty starting in September, 1947. Applicants must be engineering, science, or mathematics graduates. Salary will depend on experience and general qualifications.

Apply to the Secretary of the Faculty of Applied Science and Engineering, Mining Building, University of Toronto.

The Public Service of Canada
REQUIRES

A CHIEF PENITENTIARIES ENGINEER—
$4,800-$5,400, Department of Justice, Ottawa.

A MECHANICAL ENGINEER—
$4,800, Post Office Department, Ottawa

A CIVIL ENGINEER—
$4,200, Department of Transport, Ottawa

A LAND SUPERVISOR—
$3,600, Department of Public Works, Ottawa.

Full particulars on posters in Post Offices, National Employment Service Offices, or Offices of the Civil Service Commission throughout Canada. Application forms, obtainable thereat, should be filed immediately with the

CIVIL SERVICE COMMISSION OF CANADA, OTTAWA.

MECHANICAL ENGINEER
for
Northern Ontario Paper Mill

Age 30 to 38. Preference to man with paper mill experience or with at least seven years' experience in general layout and design. Must be good draughtsman. Knowledge of pump capacities, piping, conveyors, estimating and structural design essential. Must have good personality plus drive and ability to teach. Salary commensurate with ability and experience. Prerequisites include interview and medical examination. Apply to File No. 3891-V.

Engineering Graduate
Required

In a small city by the sea, there is an opening for a qualified designer of miscellaneous public utility buildings in frame and masonry construction. A thorough working knowledge of timber, reinforced concrete and steel framing is essential, together with ability to develop general plans and elevations compatible with sound architectural convention. Proficiency in the design of various types of heating systems, and plumbing is also a requirement, together with familiarity with electric lighting practice. The applicant should be a graduate, preferably in Civil or Architectural engineering. The position carries a reasonable salary, pension privileges and annual vacation. With candidate whose record of experience indicates suitability for this position, an interview can be arranged. Apply to File No. 3887-V.

Situations Wanted

GRADUATE HIGHWAY TRAFFIC AND TRANSPORTATION (Yale) and CIVIL ENGINEER (U.N.B.), Jr. E.I.C., age 26, married, several years experience, primarily in highways. Is interested and trained for traffic engineering positions in the following departments—police, city planning, city engineering, provincial highways; also in consulting engineering, transit and transportation companies, and Safety work with Safety and Insurance Organizations. Apply to File No. 184-W.

SECOND YEAR ENGINEERING STUDENT at McGill University, S.E.I.C., forced to abandon, would like to be trained as a sales engineer by a responsible concern. Age 23, single, good appearance and personality, free to travel and bilingual. Apply to File No. 339-W.

CIVIL ENGINEER, P.Eng. (Ont.), M.E.I.C., Diploma in Civil Engineering, University of Toronto, would like spare time work at design of structural steel or reinforced concrete on a fee basis. Would also consider checking structural steel details or estimating. At present employed in Niagara District. Apply to File No. 613-W.

GRADUATE CIVIL ENGINEER, S.E.I.C., P.Eng.(Que.), B.Sc. Queen's with some experience would accept part time work during evenings or week ends, at home preferably, on reinforced concrete and steel construction design problems, including preliminary or detailed plans. Presently employed and residing in Montreal area. Apply to File No. 1487-W.

CIVIL ENGINEER, M.E.I.C., P.E.Q., would accept work at night. Design and checking of reinforced Concrete structures, estimates, Hydraulic. At present employed in Montreal. Apply to File No. 1527-W.

ELECTRICAL ENGINEER, M.E.I.C., with twenty years experience in Sales and Technical Service of Electrical Machinery and Allied Equipment and at present manager of bis department, is looking for position with a broader borizon. Apply to File No. 1854-W.

MECHANICAL ENGINEER, B.Sc., M.E.I.C., P. Eng. (Que.), Queen's 1936, age 32, married; has 11 years of diversified and intensified experience to offer; including design, construction, maintenance, production, supervision, and management, in industry utilizing heavy machinery; wisbes to contact companies re-openings in sales, production, or management leading to executive responsibility. Apply to File No. 2006-W.

GRADUATE ELECTRICAL ENGINEER (1939) M.E.I.C., M.I.R.E. Six years' experience in maintenance and installation of Naval Radar and Radio equipment including three years administration and supervision of large staff (both civilian and Naval personnel) engaged in such work; also two years, miscellaneous industrial experience including one year as Junior Engineer at Oil Refinery; Licensed Radio Amateur since 1932; Age 30, married, one child; interested in engineering, sales or district representative position particularly in Maritime Provinces or Newfoundland. Apply to File No. 2427-W.

MECHANICAL ENGINEER, M.E.I.C., 44 years, married, nineteen years, industrial experience, steel and iron foundries, machine shop, chief draughtsman, machine design, plant layout, cost estimating, job evaluation, time study, production supervision, work layout, foreman training, excellent in labour relations, sales representation, customer contact. Apply to File No. 2555-W.

HYDRAULIC ENGINEER, B.Sc., M.E.I.C., 20 years experience in Hydraulics relative to hydro-electric power development, hydraulic machinery design and manufacture and development in hydraulic turbine design. Experience in handling men. Desires change in position. Apply to File No. 2638-W.

MECHANICAL ENGINEER, Jr.E.I.C., P.E.Q., B.Sc. Age 32, married. Presently engaged in Montreal area, would prefer position in Eastern Ontario. Experience includes machine design, jig tool and die design, methods engineering, design development plant layout, engineering department organization. 4½ years as Chief Engineer. Also experience in construction industry on building, mechanical and electrical trades. Salary $425.00 per month. Available one months notice. Apply to File No. 2682-W.

ELECTRICAL-MECHANICAL ENGINEER, Jr. E.I.C., age 30, graduate of Naval Electrical Engineering Officers course at Nova Scotia Technical College, 1945. Graduate of Naval Electrical Artificer's course at University of Alberta, followed by 6 months of instructional work on same. One year at sea as Chief Electrical Artificer on frigate in charge of all electrical equipment. Completed apprenticeship as machinist in railway repair shops in design work testing, research and calculations. Available on two weeks notice. Apply to File No. 2693-W.

YOUNG MECHANICAL ENGINEER, B.A.Sc., Toronto, S.E.I.C., single, now engaged in product design and development with firm in the Maritimes, would prefer similar work in Southern Ontario requiring more technical and also more artistic ability. Apply to File No. 2818-W.

METALLURGICAL ENGINEER, M.E.I.C., with 13 years' experience in light metals, copper, zinc and their alloys, would like to change his position. Experience covers remelt, extrusion, rolling and drawing. Operating as well as research and development work and technical sales service. Interested in a responsible position primarily in sales development work. Would be available on a 2 month notice. Age 39, married, bilingual. Apply to File No. 2844-W.

ELECTRICAL ENGINEER, (Man. '46) S.E.I.C., age 24, desires sales engineering position. Limited sales experience but possesses great potential. For full details of qualifications apply to File No. 2846-W.

MECHANICAL ENGINEER, Jr.E.I.C., graduate Queen's 1945, age 24, single. For three summers employed in auto plant maintenance. One year and a half experience in designing and draughting of Hydraulic and Plastic Machinery, estimating. Desires responsible position connected with production or industrial maintenance with a smaller progressive company. Prefers Ontario or Western area. Apply to File No. 2849-W.

CHEMICAL ENGINEER, Jr.E.I.C., McGill '27, married. Experienced manager, in charge personnel, production, purchasing. Synthetic resin research, distillation. Plant and laboratory control, time study, sales. Available immediately. Bilingual. $4,500. year last position. Apply to File No. 2850-W.

CIVIL ENGINEER, M.E.I.C., O.L.S., R.P.E., B.Sc., age 27, single, ex-R.C.E. officer desires position with Canadian or American firm engaged in structural engineering work to do design, layout and supervision of construction in Canada or foreign countries. Apply to File No. 2851-W.

YOUNG STATISTICAL METHODS ENGINEER, Jr. E.I.C., B.A.Sc. would accept some consulting work at night or Saturdays. Thoroughly familiar with statistical analysis of data, sampling inspection plans and charting methods for process, quality or material control. Actually employed as a technical advisor in statistical methods by a large industrial plant in Montreal. Apply to File No. 2862-W.

RECENT GRADUATE IN ENGINEERING Physics, S.E.I.C., B.A.Sc. Toronto, age 23, single. Specialized in Electricity and Communications 1 year experience in Electrical Field, available for Permanent position. Apply to File No. 2869-W.

CIVIL ENGINEER B.A.Sc. Toronto 1940. Jr. E.I.C., P.Eng. Ontario. 7 years experience plant maintenance, cost analysis and project development in small part machining and sheet metal industry including all phases of forming and welding. Desire this type of work in Toronto area. Apply to File No. 2870-W.

MECHANICAL ENGINEER, Jr. E.I.C., P.Eng., (Ont.), graduate of the U. of Sask., '42 with distinction ,Member of American Society for Metals, age 28, single. Five years experience in machine shop production and methods, changes in tool and product design, heat treating, inspection and testing of metals and materials; arc and oxy-acetylene welding; foundry problems in cast iron, brass, bronze, malleable iron and die castings. Completed a two year engineering apprenticeship course in a large manufacturing plant. First prize for tecbnical paper. Health excellent. Willing to work on probation for one month. Desires position to utilize the above experience Apply to File No. 2871-W.

WORKS MANAGER, GRADUATE ENGINEER, M.E.I.C., P.E. Ont., 15 years, experience in executive and production management in Electrical or Mechanical field. Available immediately. Toronto area preferred. Apply to File No. 2873-W.

MECHANICAL ENGINEER (Sask. 46), S.E.I.C., at present employed but available on short notice, desires position in maintenance, plant, production, or industrial engineering. One year's experience in draughting and detail work. Prefer to work in Ontario. Apply to File No. 2874-W.

CIVIL ENGINEER, Jr. E.I.C., veteran. age 31 with experience in road construction including layout, design, selection of materials as well as supervision and direction of equipment; also experience in building design; wishes to contact firm dealing primarily in earth and concrete construction or building construction, design or supervision. Location in Western Canada preferred. At present employed in general engineering. Apply to File No. 2875-W.

ELECTRICAL ENGINEER, M.E.I.C. Thorough grounding in cable manufacture development and estimating. Also extensive instrument making experience in Government laboratories. Interested in applying above capabilities in Toronto area. Present work power development. Age 26, single. Apply to File No. 2876-W.

ELECTRICAL ENGINEER, S.E.I.C., P.E.Q., graduated '46 with two years experience in electrical installations in public buildings desires any kind of work, preferably in the vicinity of Montreal, Ottawa or Toronto. Available July 1st. Age 26, married, bilingual. Apply to File No. 2881-W.

MECHANICAL ENGINEER, Jr.E.I.C., McGill '44, age 26, bilingual, single, good health. Due to an unusual situation, has not been employed in work of an engineering nature since graduation. Would prefer to locate with organization building custom-built automatic industrial machinery. Available on short notice for assignment in Canada or U.S.A. Apply to File No. 2882-W

GRADUATE MECHANICAL and ELECTRICAL ENGINEER (M.I. Mech Eng. & A.I. Electrical Eng. of England—M.E.I.C., P.Eng. Ontario.) with sound experience in mechanical and electrical plant and foundry production and factory management including industrial engineering methods of plant layout, job evaluation, work measurement, labour control and machine utilization; at present engaged as plant manager in complete charge of engineering works, desires to better his position. Apply to File No. 2883-W

ELECTRICAL ENGINEER, M.E.I.C., P.Eng., age 30, married, Ex-Naval Lieut., 12 years experience including maintenance mines, process industries elect. mfrc., C.G.E. test; at present employed but seeks connection with aggressive organization. Available November. Prefer Ontario Location. Apply to File No. 2884-W.

THE ENGINEERING INSTITUTE OF CANADA

PRELIMINARY NOTICE

of Applications for Transfer from the Class of Junior

September 15th, 1947.

e By-laws provide that the Couneil of the Institute shall ›ve, classify and elect candidates to membership and transfer one grade of membership to a higher.

is also provided that there shall be issued to all corporate bers a list of the new applicants for admission and for fer, containing a concise statement of the record of each cant and the names of his references.

order that the Council may determine justly the eligibility of candidate, every member is asked to read carefully the list iitted herewith and to report promptly to the Secretary any which may affect the classification and selection of any of candidates. In cases where the professional career of an cant is known to any member, such member is specially ed to make a definite recommendation as to the proper ification of the candidate.

to your knowledge facts exist which are derogatory to the inal reputation of any applicant, they should be promptly nunicated.

mmunications relating to applicants are considered he Council as strictly confidential.

ie Council will consider the applications herein described at November meeting.

L. Austin Wright, General Secretary.

ie professional requirements are as follows:—

Member shall have been engaged in some branch of engineering for at six years, which period may include apprenticeship or pupilage in a quali-ngineer's office or a term of instruction in a school of engineering nized by the council. In every case a candidate for election shall have held tion of professional responsibility for at least two years. The occupancy of hair as professor, assistant professor, associate professor or lecturer in a y of applied science or engineering, shall be considered as professional nsibility.

ery candidate who has not graduated from a school of engineering recog- by the council shall be required to pass an examination as prescribed by il, on the theory and praotice of engineering, with special reference to ranch of engineering in which he has been engaged.

Junior shall have been engaged in some branch of engineering for at least years. This period may be reduced to one year, if the candidate for election raduated from a school of engineering recognized by the council, in which he shall not remain in the class of Junior beyond the end of the eighth after graduation.

ery candidate who has not passed the examinations of the third year in a l of engineering recognized by council shall be required to pass an examina- n engineering science as prescribed by council. He shall not remain in the of Junior beyond age thirty.

Junior may be transferred to Member without payment of transfer fee ding he makes application before the end of the seventh year after gradua- or, if a non-graduate, before attaining age twenty-nine, and his application proved by council.

uncil may extend the above limits if in its opinion special circumstances ant such extension.

Student shall be at least seventeen years of age, and shall present a certi- e of having passed an examination equivalent to the final examination of a school, or the matriculation of an arts or science course in a school of ieering recognized by the council or shall be required to write examinations escribed by the council.

shall be:

pursuing a course of instruction in a school of engineering recognized by the cil, in which case he shall be transferred to Junior automatically without nent of transfer fee in the second January after graduation, or

rsceiving a practical training in the profession in which case he shall be sferred to Junior without payment of transfer fee providing he makes ication before attaining age twenty-five and his application is approved by cil.

e shall not remain in the class of Student after he has attained the age of ity-five, unless in the opinion of council special circumstances warrant the nsion of this age limit.

Affiliate shall be one who is not an engineer by profession but whose uits, scientific attainments or practical experience qualify him to co- ate with engineers in the advancement of professional knowledge.

The fact that candidates give the names of certain members as reference does not necessarily mean that their applications are endorsed by such members.

In view of the large number of applications for transfer from the class of Junior to that of Member, received under the provisions of the recently revised by-laws, it has been decided by Council, upon the recommendation of the Admissions Committee, to issue this list as a supplementary leaflet to accompany the September *Journal*.

If those members whose names have been given as references will return promptly the forms sent to them it will be of great assistance to Headquarters.

ADLAM—ARTHUR EDWIN, of Toronto, Ont. Born at Chamberlain, Sask., June 22, 1910. B.E., Univ. of Sask., 1935; R.P.E., Ontario, 1937-1940, asst. mining & civil engr., Canadian Johns Manville, Asbestos, Que.; Feb.-Sept., 1940, engr. dftsmn., British American Oil Refinery, Montreal, Que.; 1940-41, structural steel detailer, Hamilton Bridge Co., Hamilton, Ont.; 1941-43, engr. dftsmn., Welland Chemical Works, Welland, Ont.; Feb.-Nov., 1943, concrete dftsmn., Atlas Steels Ltd., Welland, Ont.; Nov. 1943 to date, asst. engr. i/c strctl. dftsmn. Rapid Transit Dept., Toronto Transportation Commission. (Jr.1940).

References: W. H. Paterson, F. M. C. Sefton, G. F. Morrison, G. Graham, R. F. A. Smith.

AIN—JOSEPH, of Montreal, Que. Born at Swistoez, Poland, Dec. 1, 1912. Educ.: B.Eng., McGill, 1939; R.P.E., Quebec; 1939-40, asst. constrn. engr., H. Zakute, Montreal, Que.; 1940-44, asst. to res. engr., then, res. engr., Dept. of Transport; at present, partner, Ain & Zakute, Montreal, Que. (Jr.1941).

References: I. Backler, L. Berenstein, J. P. Leroux, L. Shector, E. Brown.

ALEXANDER—ALWIN PAUL, of Vancouver, B.C. Born at Granum, Alta., July 9, 1909. Educ.: B.Sc., (Elect.), Alberta, 1933; R.P.E., Ontario; 1933-41, business for self; 1942-44, shift electrician, then asst. chief elect. i/c mtce. & constrn. at sintering plant, Algoma Ore Properties; with Algoma Steel Corp. Ltd., Sault Ste. Marie, as follows: 1944-45, jr. elect. engr., 1945-46, elect. engr., i/c blast furnace and ore handling elect. equipt.; 1947 to date, elect. engr., Hume & Rumble Ltd., Vancouver, B.C. (St.1933. Jr.1943).

References: J. Donnelly, F. A. Becker, J. L. Lang, A. H. Russell, F. H. MacKay, G. G. W. MacLeod.

ANTENBRING—STANLEY VICTOR, of Sarnia, Ont. Born at Winnipeg, Man., Oct. 7, 1916. Educ.: B.Sc., (Civil), Manitoba, 1937; R.P.E., Ontario; 1937-41, design refinery, plant layout, steel structures, etc.; with R.C.A.F., as follows: 1941, completed course in aero. engrg., 1941-42, design details, Ottawa, 1942-44, i/c prod. & developt., calculations of airborne Radar instlns., etc.; 1943 to date, engr. i/c drawing office, design in mech. dept., estimating, supvrn, constrn., Imperial Oil Limited, Sarnia, Ont. (Jr.1940).

References: C. P. Warkentin, G. L. Macpherson, A. E. Macdonald, G. H. Herriot, C. W. Crossland, F. F. Dyer.

ARCHER—MAURICE, of Quebec, Que. Born at Quebec, Oct. 4, 1910. Educ.: B.Eng., (Civil), McGill, 1933; R.P.E., Quebec; 1933-36, engr., Z. Langlois, consultg. engr.; 1937 to date, consltg. engr. with Archer & Dufresne, Quebec, Que. (St.1933. Jr.1938).

References: H. Cimon, P. A. Dupuis, R. Talbot, L. Trudel.

AYERS—FRANK EDWARD, of Fort William, Ont. Born at Saskatoon, Sask., Jan. 14, 1921. Educ.: B.Sc., (Civil), Saskatchewan, 1943; R.P.E., Ontario; 1943-45, Lieut. R.C.E.; 1946 to date, instru'man. with Canadian National Railways, Port Arthur Division. (Jr.1945).

References: R. A. Spencer, I. M. Fraser, N. B. Hutcheon, W. E. Lovell, E. K. Phillips.

BAKER—BENJAMIN O., of Quebec City. Born at Portage La Prairie, Man., Jan. 10, 1917. Educ.: B.Sc. (Elec.), Man., 1940; R.P.E., Quebec; 1940-41, test dept., Can. Genl. Elect. Co., Peterboro, Ont.; 1942-43, engrg. dept., Genelco Ltd.; 1943-44, armament design dept., Ministry of Supply, London, England; with Can. Gen. Elec. as follows: 1944, industrial control engrg. dept.; 1945-46, general engrg. dept., Peterboro, Ont.; 1946 (Nov. to date), research scientist, Can. Armament Research and Establishment, Valcartier, Que. (St.1940. Jr.1946).

References: D. C. Rose, I. F. McRae, G. R. Langley, J. L. McKeever, E. P. Fetherstonhaugh.

BARKER—FREDERICK GEORGE, 10c Brittany Row, Arvida, Que. Born at Montreal, Nov. 6, 1917. Educ.: B.Eng., (Chem.), McGill, 1939; 1939-40, chem. engr., Shell Oil Co. of Canada Ltd.; with Aluminum Co. of Canada Ltd. as follows: 1940-44, junior engr. & supervisor; 1944-47, asst. supt., Fluoride Divn., Arvida Works, and at present supt. (Jr.1945).

References: F. T. Boutilier, B. E. Bauman, A. C. Johnston, T. L. Brock, J. F. Braun, G. M. Mason, F. A. Dagg.

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References: G. L. Colpitts, K. R. Shipley, R. L. Dunsmore, C. Scrymgoeur, L. E. Mitchell, C. J. Bullick, R. L. Blackett.

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References: S. G. Coultis, F. R. G. Wrigley, H. P. Cadario, R. M. Hardy, H. J. MacLeod, R. S. L. Wilson.

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References: C. J. Mackenzie, E. K. Phillips, E. S. C. Carpenter, G. H. L. Dempster, N. B. Hutcheon, I. M. Fraser.

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References: A. Frigon, A. G. S. Murphy, T. J. Lafreniere, L. Trudel, H. Massue, J. N. Langelier.

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References: A. J. Foy, L. Trudel, L. Nadeau, M. Boyer.

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References: D. S. Ellis, I. N. MacKay, B. J. McColl, D. M. Jemmett, A. Jackson.

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References: E. O. Turner, R. R. Willis, D. J. Brewer, W. E. Smith, R. E. Tweeddale.

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References: C. Bentall, C. W. Deans, J. N. Finlayson, A. Peebles, P. B. Stroyan.

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References: F. H. Sexton, E. L. Baillie, L. E. Mitchell.

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References: G. Dick, P. Vincent, B. Killam, S. D'Aeth.

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References: D. C. Tennant, J. T. Dyment, R. DeL. French, T. R. Loudon, H. Crombie.

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References: R. L. Dobbin, V. S. Foster, A. R. Jones, J Allan, A. L. Malby, J. Breakey.

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References: E. Brown, C. M. McKergow, R. S. Eadie, J. Smi R. H. Findley, R. H. Patten, J. H. Ingham, M. B. Halpenny.

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References: V. W. MacIsaac, A. D. Harris, G. W. Lusby, W. Donnelly, H. Lillie.

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rences: O. Holden, J. J. Traill, G. R. Lord, R. W. Angus, Parkin, J. R. Montague, C. R. Young.

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rences: I. M. Fraser, N. B. Hutcheon, R. E. Smallwood, Peterson, R. A. Spencer, J. H. Maude.

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rences: J. A. McCrory, R. E. Heartz, G. R. Rinfret, A. L. son, E. V. Leipoldt, H. K. Wyman, J. S. Whyte.

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rences: R. E. Chadwick, R. DeL. French, G. M. Wynn, Wright, J. A. Coote.

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erences: D. N. McCormack, C. W. Boast, D. A. Evans, Sandwell, W. Jamieson, C. C. Ryan.

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erences: D. J. Irvine, C. J. Mackenzie, R. A. Spencer, Holder, J. H. Legg.

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erences: H. C. Anderson, H. L. Hayne, F. B. Whiteley, Turner, F. T. Brown.

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erences: L. S. Cossitt, G. D. Hulme, E. R. Jacobsen, F. S. , R. Lanctot.

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References: A. G. Moore, H. C. Karn, J. R. Auld, R. H. Robner, P. Varley, J. T. Howley, J. Zorzi.

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References: H. Gaudefroy, J. C. Belque, L. Cartier, L. Trudel, J. Laurence, A. R. Leblanc.

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References: R. W. Teagle W. B. Redfern, G. L. Colpitts, C. J. Bullick, R. W. Angus.

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References: F. G. Kerry, G. H. Griffith, T. Kennedy, J. R. Stewart, C. E. Morse.

DAIGNAULT—LAURENCE GEORGE, of Montreal, Que. Born at Montreal, Que., May 17, 1911. Educ.: B.Sc., (Civil), McGill, 1934; R.P.E., Quebec; 1934-35, Truscon Steel Co. of Canada, Ltd., Montreal, Que.; 1945 to date, chief engr. i/c of supvr. and sales, Dufresne, McLagan and Associates, Regd., Montreal, Que. (St.1933. Jr.1940).

References: J. A. Beauchemin, J. A. Lalonde, G. H. Burdett, H. Gaudefroy, L. Trudel, T. R. McLagan, G. E. Surault, J. Benoit, A. Cormier, G. N. Martin.

DAVIS—FREDERICK ALLAN, of Toronto, Ont. Born at Montreal, Que., Sept. 4, 1916. Educ.: B.Sc., (Chem. Engrg.), Queen's, 1940; R.P.E., Ontario; 1940, (7 mos.), supvr., Canadian Industries Ltd., Brownsburg, Que.; with British American Oil Co., Ltd., as follows: 1940-41, asst. engr., Montreal refinery; 1941-42, refinery engr., Montreal; 1942-45, asst. to chief engr., Toronto; 1945-46, asst. process engr., Clarkson refinery, 1946 to date, chief process engr., Toronto, Ont. (Jr.1941).

References: F. A. Gaby, D. S. Ellis, R. F. Legget, I. S. Widdifield, W. E. Lundie.

DAVIS—STUART GEORGE, of Edmonton, Alta. Born at Lethbridge, Alta., June 15, 1917. Educ.: B.Sc., (Chem. 1939, M.Sc. 1940), Univ. of Alta., Ph.D., McGill, 1942. May-Sept. 1942, research chemist, Canadian Industries, Ltd., Beloeil, Que.; 1942-46, lecturer in chemistry, Univ. of Alta.; 1946 to date, asst. prof. chemistry, Univ. of Alta.; 1942 to date, research consultant. (St.1942. Jr.1946).

References: J. A. Allan, R. M. Hardy, J. W. Porteous, L. A. Thorssen, I. F. Morrison.

DELAGE—JEAN BAPTISTE, of Montreal, Que. Born at Charlesbourg, Que., July 24, 1917. Educ.: B.A. & B.Sc., Laval Univ., 1941; R.P.E., Quebec. 1941-42, asst. surveyer and engr., Malartic Gold Field Ltd.; 1942-43, AC2, radio-mech., R.C.A.F.; 1943-45, Army-Lieut. engr., training troops, field engrg., bridging; 1945-47, captain engr., works officer, Farnham camps & Eastern Township armouries, 1945-46; 1946 to date, ch. engr., Longue Pointe Ordnance Depot, works officer, H.Q. Quebec Command, i/c cnstrn., heating, mtce. in general. (Jr.1945).

References: H. W. Love, E. C. King, S. Slater, C. A. Duranceau, P. E. Gagnon, A. Pouliot, R. Leblanc.

DESLAURIERS—CHARLES-EDUOARD, of Quebec, P.Q. Born at Quebec, Nov. 2, 1913. Educ.: B.A.Sc., C.E., Ecole Polytechnique, 1940; R.P.E., Quebec. June to Dec. 1940, prodn. engr. and machine designer, Sorel Industries, Ltd., Sorel; 1940-44, jr. engr.; 1944-45, sr. engr., and 1945 to date asst. ch. engr., Hydraulic Service, Dept. of Lands and Forests, Que., civil engrg. works on hydrology, hydraulics, hydro-electric power dvlpmt., examination and approval of plans and specifications of works in the water courses of Quebec; Prof. of Applied Mathematics at Laval Univ. (St.1940. Jr.1942).

References: L. Gagnon, A. E. Pare, M. Royer, A. B. Normandin, R. Dupuis, P. Vincent.

DESMARAIS—JEAN RENE, of Montreal, Que. Born at Montreal, Que., Sept. 21, 1911. Educ.: B.A.Sc., C.E., Ecole Poly., 1937; R.P.E., Quebec. With Canadian General Electric Co., Ltd.; 1937-38, test course; 1938-39, engrg. dept., Peterboro works; 1939-40, head office, Toronto; 1940-41, district office, Montreal; 1941-43, R.C.A.F., Engr. Officer in Canada and subsequently, Elect. Engr. Officer, England; 1946 to date, asst. to supt. engr., Electrical Commission, City of Montreal, Que. (St.1936. Jr.1938).

References: deG. Beaubien, G. E. Templeman, A. N. Scott, A. Benjamin, A. Ferrier.

DesORMEAUX—DOLLARD, of Montreal, Que. Born at Montreal, Que., June 24, 1913. Educ.: B.A.Sc., C.E., Ecole Poly., 1937; R.P.E., Quebec. With City of Montreal, as follows: 1937-41, surveying, inspection, cost appraisals for real estate assessing purposes, engrg. dept.; 1941-46, tech. secretary, engrg. divn., Public Works Dept.; 1946 to date, engr. with section of municipal improvements of engrg. divn., Montreal, Que. (St.1936. Jr.1940).

References: J. G. Caron, J. J. Comeau, C. E. Gelinas, H. A. Gibeau, J. R. Rousselle, W. Dickson.

DeSTEFANO—FRANK JOSEPH, of Sudbury, Ont. Born at Sudbury, Ont., Nov. 23, 1909. Educ.: B.Sc., 1935, professional degree, Civil Engineer 1941, Michigan College of Mining & Technology; R.P.E., Ontario; 1935-46, field engrg. dept. on cnstrn. of mining plants, mills, smelter, International Nickel Co.; at present estimating for C. G. Carrington Construction Co., Sudbury. (Jr.1936).

References: C. O. Maddock, J. F. Robertson, W. J. Ripley, F. A. Orange, P. G. Benjafield.

deTONNANCOUR—CHARLES G., of Shawinigan Falls, Que., Born at Montreal, Que., May 8, 1913. Educ.: B.Eng. (Chem.), McGill, 1940; R.P.E., Quebec; 1940-43, asst. to devlpmt. engr., Shawinigan Chemicals Ltd., in design of chemical units and projects for Allied War Supplies and Shawinigan Chemicals; 1943 to date with Canadian Resins & Chemicals, Ltd. as follows: 1943-45, plant supervisor; 1945-46 plant engr., i/c cnstrn. and design on Fabricating Divn. of Can. Resins at Shawinigan Falls, now completed; 1946 to date, plant engr., Canadian Resins & Chemicals Ltd. (St.1940. Jr.1942).

References: J. S. Whyte, H. K. Wyman, R. Dorion, R. E. Heartz, M. Eaton, R. deL. French, Viggo Jepsen.

DEWAR—GEOFFREY PLUMMER, of Montreal, Que. Born at Montreal, Que., Nov. 27, 1917. Educ.: B.A.Sc., Toronto, 1940; with Royal Canadian Engineers, as follows: 1941-42, Regimental Officer, 18th Field Coy.; 1942-43, Staff Officer, Grade 3 with rank of Capt., instructor in engrg. organization; 1943-45, Staff Officer, Grade 2, with rank of Major, asst. to Chief Engr., 2 Cdn. Corps, responsible for organizing demobilization of Cdn. Engr. Units overseas; at present, asst. to chief plant engr., i/c large contract work such as roads, sewers, water lines, elect. conduits, oil lines and earth moving, Imperial Oil Limited, Montreal East. (Jr.1944).

References: V. C. Hamilton, C. Scrymgeour, J. J. Rowan, C. W. E. Miles, F. T. Brown, A. S. Rutherford.

DICK—SIDNEY ALEXANDER, of Kapuskasing, Ont. Born at Milton, Ont., Apr. 15, 1913. Educ.: B.Sc., Queen's, 1940; R.P.E., Ontario; 1940-41, cadet engr.; 1941-42, sales & Services engr., Bailey Meter Co.; With R.C.N.V.R. as follows: 1942-43, Sub./Lt. (E) in training; 1943-44, Lt. (E) engr. officer, i/c minesweeper; 1944-45, Lt. (E) engr. officer, i/c Frigate; 1945 to date, heat engr., Spruce Falls Power & Paper Co. Ltd. (Jr.1944).

References: C. W. Boast, G. Thompson, J. W. Brooks, D. N. McCormack, J. A. Ferrier.

DICK—WILLIAM ARTHUR, of Montreal, Que. Born at Glasgow, Scotland, June 20, 1914. Educ.: B.Eng. (Mech.), McGill, 1937; With American Can Co., Montreal and New York, as follows: 1937-39, asst. to master mechanic; 1939-1940, New Devlpmt. Dept., New York; 1940-42, asst. to supt.; 1945-47, asst. to plant mgr., Hamilton, Ont., Research Divn.; 1942-45, R.C.N.V.R., Lieut. (E) i/c machinery, minesweepers and frigates. (St.1937. Jr.1943).

References: N. M. Barclay, A. C. D. Blanchard, W. N. Cann, A. Ferguson, J. Smith.

DOBBIN—DAVIN CRAWFORD, of Ste. Anne de Bellevue, Que. Born at Westmount, Que., Feb. 24, 1911. Educ.: B.Eng. (Civil), McGill, 1932; R.P.E., Quebec; With Dominion Rubber Co. as follows: 1934-38, time study, St. Jerome, Que.; 1938-40, plant layout and devlopmt. work, St. Jerome; 1941-42, plant layout, Montreal; Jan. 1946 to June 1946, project. engr., Footwear Div., Montreal; 1942-45, EME, Canadian Army overseas, O i/c vehical repair, gun repair, tank repair, i/c inspn. dept. of large workshop; July 1946 to Feb. 1947, intermediate engr., and Feb. 1947 to date, sr. engr., Stevenson & Kellogg Ltd., Montreal. (St.1931. Jr.1938).

References: P. Kellogg, J. E. Dion, C. V. Christie, R. Ford, J. Lefort, T. M. Moran.

DONALDSON—DAVID RENNIE, of Seattle, Wash. Born at New Westminster, B.C., May 2, 1916. Educ.: B.A.Sc., (Civil), British Columbia, 1939. With Boeing Aircraft of Canada Ltd., as follows: 1939-41, inspectr., tool & jig. designer; 1941-43, liaison officer i/c investigating shop problems, working with Consolidated Aircraft Corp., San Diego, Calif.; 1943-45, project engr. i/c PBY airplane engrg., responsible for redesigns to facilitate prod., etc.; 1945-46, lead. engr. in preliminary design section of engrg.. investigated proposed future military aircraft; at present, stress analyst, Boeing Aircraft Co., Seattle, Wash. (Jr.1940).

References: J. N. Finlayson, L. G. Scott, A. Peebles.

DUCKETT—WILLIAM ANDERSON, of Chambly, Que. B
at Montreal, Que., Nov. 10, 1913. Educ.: B.Eng. (Elect.), Mc
1937; R.P.E., Quebec. 1943-46, war service, Army, staff off
Natl. Defence H.Q., Ottawa, genl. tech. work in connection v
defence radio and telephone installns.; with Bell Teleph
Co. as follows: 1937-41, telephone cnstrn., repair and m
1941-42, asst. engr., design of outside telephone distribu
plant; 1946-47, engr., transmission design of telephone distri
tion plant. (St.1935. Jr.1942).

References: C. G. Cline, C. V. Christie, W. L. Laurie.

DUFFY—FRANK H., of Arvida, Que. Born at Saint J
N.B., Mar. 31, 1918. Educ.: B.Sc. (Elect.), Univ. of N.B.,
R.P.E., Quebec. 1939-41, radio operator, station CFNB, F
ericton, N.B.; 1941-42, asst. distribution engr., Saguenay Po
Co., Arvida; 1942-44, asst. protection engr., and 1944 to d
system protection engr., Aluminum Co. of Canada, Ltd., S
shaw, Que. (St. 1939. Jr.1944).

References: A. C. Johnston, F. L. Lawton, J. E. Thicke,
Robert, H. R. Fee, E. W. McKernan, C. Miller.

DUFOUR—GASTON MAURICE, of Arvida, Que. Born
Montreal, Que., April 16, 1911. Educ.: B.A.Sc., C.E., Ecole P
1937 R.P.E., Quebec. 1937-38, engr., Brown Corporation 193
engr., Public Works of Canada; 1940 to date, Aluminum Co
Canada, as engr., and at present, employment mgr., Ar
Que. (St.1936. Jr.1941).

References: McN. DuBose, F .T. Boutilier, B. E. Bauman
Miller, M. S. Saunders, R. A. Lemieux.

DUNCAN—FREDERICK ROBERT, of Toronto, Ont. Born
Fort William, Ont., Feb. 1, 1918. Educ.: B.Eng., McGill,
R.P.E., Ontario. With Canadian General Electric Co., Ltd.
follows: 1940-41, test course; 1941-44, patent and legal d
1944-46, Lieut., Royal Canadian Corps of Signals; 1946 to
asst. to president, J. R. Longstaffe Limited, Toronto,
(St.1939. Jr.1945).

References: G. R. Langley, W. L. Bird, G. R. Duncan
A. Shupe.

DUNLOP—JAMES RUSSELL, of Ottawa, Ont. Born at
tawa, Dec. 13, 1907. Educ.: B.Eng., (Mech.), McGill, 1935.
34 and 1935-36, asst. to mech. supt., E. B. Eddy Pulp & P
Mill; 1936-39 dftsmn., cnstrn. and alteration, Canadian I
national Paper Co., Gatineau, Que.; 1939-45, Canadian A
Overseas, R.C.E.M.E., command of workshops for repair
techl. army equipmt.; 1946-47, Canadian Army Canada,
ning and organizing postwar army repair shops for tech
equipmt. Asst. Director of Mechl. Engrg., R.C.E.M.E. (St
Jr.1937).

References: G. Stephenson, A. N. Ball, H. G. Thompson
L. Franklin, N. C. Sherman, J. W. Bishop, D. M. Cooke
F. Bennett.

DUNN—JOHN RANKIN, Lt. Col. (L), of Ottawa, Ont. Bo
Moose Jaw, Sask., Aug. 21, 1916. Educ.: B.A.Sc., (Elect.), Tor
1938; with Canadian General Electric Co., Ltd., as follows:
39, testman; 1939-40, engr. in training; 1940-41, jr. engr.;
Royal Canadian Navy as follows: 1941-42, radar instln., Ha
and Ottawa; 1943, radar training, Portsmouth; 1944, air
training; 1944-45, Air Radio Officer, H.M.S. Implacable; 19
Air Radio Officer, Ottawa, and at present, Elect. Officer, I
Canadian Naval Reserve, D.E.E., N.S.H.Q., Ottawa, Ont. (St
Jr.1941).

References: J. S. Keenan, G. R. Langley, W. H. G. Roge
Deane, E. G. Cullwick.

EDWARDS—MILTON CHALMERS, of Hamilton, Ont. Bo
Lethbridge, Alta., Aug. 28, 1912. Educ.: B.Sc. (Elec.) Uni
Alta., 1937. R.P.E., Ontario; With Canadian Westinghouse
Ltd. at follows: 1937-38, graduate apprentice, Hamilton, 19
sales correspondent, Vancouver; 1942-45, Signals Officer, R.C.
1945 to date, design engr., Canadian Westinghouse, Hamilton,
(St.1937. Jr.1943).

References: H. A. Cooch, A. A. Moline, J. R. Dunbar,
Tames, C. C. Smith, J. Haimes, E. R. Love.

ELLIOTT—JOHN MILTON, of Dundas, Ont. Born at Pana
nois, Nov. 24, 1916. Educ.: B.Sc. (Mech) Queen's, 1939; R
Ontario; 1939-40, understudy, Kimberly Clark Corp., Ni
Falls; 1940 (6 mos.) machinist; 1940-42, plant engr., John Be
& Sons Co. Ltd., layout & instlln. of approx. 70 machine
tooling of same, gen. mtce., supervn. of millwrights; June
1942, Jan.-Apr. 1946, designer dftsman., Mine Hoist Div
design & detail work for "Bertram Nordbeck" hoists; Apr.
1946, asst. to gen. mgr., John Bertram & Sons Co. Ltd., l
& instlln. of new equipt. and supervn. of bldg. of foundr
tension; 1942-45, Lieut., R.C.E.M.E. overseas; Nov. 1946 to
asst. supt., Donald Rope & Wire Cloth Ltd., Hamilton, On
plant & equipt. mtce., new equipt. design. (St.1936. Jr.1946

References: R. F. Wilson, H. G. Bertram, W. J. W. Rei
Love, D. S. Ellis.

ELLIS—GWILLYM LIONEL TOWNSHEND, of Niagara
Ont. Born at Edgeley, Sask., July 29, 1909. Educ.: B.Sc., (M
Saskatchewan, 1940; 1940-41, detail & sub-assembly inspe
1941, time study engr., Massey-Harris, Toronto; 1941-43,
heating & vent. engr., design and layout, Weathermakers'
Toronto, Ont.; 1943-45, Aero. Inspectr., R.C.A.F.; asst. he
& vent. engr., air cond. & dust collecting, Carborundum
Niagara Falls, N.Y. (S.1940. Jr.1943).

References: J. B. Mantle, C. Climo, N. B. Hutcheon,
London, J. M. Fraser.

ENGLER—CHARLES ROY, of Asbestos, Que. Born at Ot
July 1, 1907. Educ.: B.Sc., Queen's, 1934; R.P.E., Ontario; 19
jr. indst. engr., Canadian Johns Manville; 1941-44, ch. dft
1945-47, sr. mech. engr., Aluminum Co. of Canada; 1947 to
mech. mtce. supt., Canadian Johns Manville, Asbestos, mine
and railway. (Jr.1937).

References: M. C. Saunders, R. Carter, K. Winslow, D. S.
H. G. Conn.

ESTABROOK—JAMES PIERCE, of Arvida, Que. Born at
laceburg, Ont., July 31st, 1916. Educ.: B.Sc. (Chem. En
Queen's, 1939; 1939-42, junior chemist, Price Bros. Ltd.,
bend, Que.; with Aluminum Co. of Canada Ltd. as follows:

:h. asst. to aluminum plant supt. at Shawinigan Falls; date, tech. asst. to magnesium plant supt. at Arvida, Que. 1).

rences: B. E. Bauman, T. A. Carter, A. H. Johnston, F. T. er, F. A. Dagg.

t—JOHN LOWTHER, of Guelph, Ont. Born at Guelph, Nov. . Educ.: B.A.Sc. Univ. of Toronto, 1935. R.P.E., Ontario; Mar.-Sept.) student eng., Canadian General Electric Co.; , asst. patent examiner, Canadian Patent Office, Ottawa, on electl. and rly. appns.; 1943 to date, research engr., Wood Co. Ltd., Guelph, responsible for research, design, on elecl. farm equipt. (Jr.1938).

rences: C. E. Sisson, G. R. Langley, E. A. Allcut, A. J. ood.

GUSON—JOHN HENRY, of Ottawa, Ont. Born at Glasgow, nd, Aug. 20, 1905. Educ.: B.Sc., (Civil), Manitoba, 1929; .C.A.F., as follows: 1939-41, overseas; 1941, Sr. Equipt. Staff , 3 Training Command; 1941-42, Commanding Officer, F. Station, East Calgary; 1942, C.O., No. 11 Equipt. Depot, y; 1942-46, C.O., No. 2 Equipt. Depot, Vancouver; 1946 to Sr. Supply Staff Officer, Mtce. Command H.Q., with rank C, Ottawa, Ont. (Jr.1931).

rences: A. Ferrier, C. A. Davidson, S. G. Tackaberry, Finlayson, W. F. Riddell.

D—JOHN FRANKLIN, of Toronto, Ont. Born at Milton, May 13, 1913. Educ.: B.A.Sc., Univ. of Toronto, 1939. R.P.E., 1939-42 and 1946-47, constrn. supt., Russell Construction oronto; 1942-46, army officer, R.C.E., incldng. works officer d., M.D. No. 1, and Germany; 1947 to date, cnstrn. supt., Rule, Ltd., Toronto. (St.1939. Jr.1940).

rences: R. F. Legget, C. F. Morrison, J. H. Russell, Roddick, R. A. Rule.

SYTHE—MARSHALL ANTHONY, of Montreal, Que. Born ikhead, Alta., July 10, 1912. Educ.: B.Sc., (Elec.), Univ. of 1937. R.P.E., Quebec; 1937-41, elecl. dftsmn., and 1941 to elecl. design of substations control, relay protecn. and ng, Shawinigan Engrg. Co. Ltd., Montreal. (St.1937. Jr.1941).

rences: J. A. McCrory, R. E. Heartz, A. L. Patterson, A. B. , J. Charnley, W. Sharples.

VLER—CHARLES ALLISON EUGENE, of Halifax, N.S. at Halifax on Jan. 24, 1921. Educ.: B.Eng. (Mech.) McGill, ummer work as follows: 1941, machine shop work, Halifax ids Ltd.; 1942, dftm'n, Dartmouth Marine Slips; 1943, 2nd dnance Mechanical Engr.; 1944-46, Elect. Mech. Engr. (Lt.) M.E., Canada, U.K. continental Europe; 1946 (6 mos.), de- g engr. C. A. Fowler & Co.; 1946-47, architectural courses, of Manitoba; April 1947, designing engr., C. A. Fowler & alifax. (St.1943. Jr.1946).

rences: C. A. Fowler, J. R. Kaye, I. P. Macnab, J. B. , T. P. Lusby, C. Roper, A. D. Foulis, H. W. McKiel.

CHETTE—GASTON, of Verdun, Que. Born at Montreal, 9, 1915. Educ. B.A.Sc., C.E., Ecole Polytechnique, 1940, Quebec; 1940-44, strctl. design, estimating, layout dftsmn., details on 10,000 ton cargos, and 1944-1946, combustion Dominion Bridge Co., Lachine; at present, ch. engr. ard Structural Steel Ltd., Montreal, and private practice. 38. Jr.1943).

rences: J. P. Lalonde, H. Borduas, R. S. Eadie, C. D. Bailey, Martin, I. S. Backler, G. O. Beaulieu.

EMAN—PAUL ORA, of Montreal, Que. Born at Montreal 2, 1921. Educ.: B.Eng., 1943, M.Eng., 1946, McGill. R.P.E. 1943-45, technical officer, Captain, R.C.E., on development idging equipment; Apr. 1946 to date, strctl. designer, nion Bridpe Co. Ltd. (St.1940. Jr.1946).

erences: D. B. Armstrong, P. G. A. Brault, C. J. Pimenoff, Dodd, R. DeL. French, R. S. Eadie.

GON—RAYMOND AUGUSTIN, of Montreal, Que. Born at eal, Feb. 24, 1915. Educ,: B.A.Sc., C.E., Ecole Polytechnique, M.Sc., M.I.T. 1941; R.P.E., Que. 1941-44, instr. in mechanics aterials, research asst., Ecole Polytechnique; 1944-45, static eng. on Burnelli Flying Wing project, Canadian Car & dry, i/c tests on aircraft components, stress calculations; 6, asst. engr., Diesel Engine Divn., Dominion Engrg. Works, diesel engine calculations and experimentation, general ine design; also lecturing Ecole Polytechnique. At present, nal representative, Research & Devlpmt. Br., Dept. of nstruction, Dominion Govt. (St.1937. Jr.1942).

erences: C. J. Mackenzie, L. Duchastel, H. Ulmann, I. llet, J. A. Beauchemin, J. B. Stirling.

SKEN—ORVAL JAMES, of 607 Homewood Ave., Peter- ugh, Ont. Born at Napanee, Ont., July 29th, 1907; Educ.: Queen's, 1929; R.P.E., Ont.; 1929-30, dftsman & heating Trane Co. of Canada, Toronto; 1930-31, dftsman. boiler de- and 1931-32, asst. proposition engr., Babcock-Wilcox & e McCulloch, Galt, Ont.; 1935-36, bldg. layout, power plant frigeration, Canadian Kodak Ltd., Mount Dennis, Ont.; 1936 ate, asst. engr., The DeLaval Co. Ltd., Peterborough, Ont. 928. Jr.1937)

erences: R. L. Dobbin, W. T. Fanjoy, F. R. Pope, E. White- D. V. Canning, V. S. Foster.

IZZLE—HAROLD ROBERT, of Oshawa, Ont. Born at eport, N.S., March 16, 1910. Educ.: B.Sc. (Elec.) N.S. Tech. 1933 1934 paving inspr. Milton Hersey Co. Ltd.; 1935-38, work, 1938-40, costing, Phillips Elecl. Works, Ltd., 1940-45, to Director Genl., genl. prodn. br., Dept. Munitions & ly (1 yr. chief small arms prodn. divn.); 1946, genl. engrg., es Conduits, Fittings, Ltd., St. Jean, Que.; 1946 to date, uctor, Univ. of Toronto, Ajax, Ont. (St.1935. Jr.1946).

ferences: W. J. T. Wright, H. L. Shepherd, R. C. P. Webster, Henderson, S. Ball, J. S. Wilson, R. Fleming.

FROMSON—SAM, of Montreal, Que. Born at Winnipeg, June 17, 1916. Educ.: B.Eng., McGill, 1938. With Canadian Vickers, Ltd., as follows: 1940-41, asst. prodn. supervisor, engrg. divn., 1941-43, foreman machine shop, 1943-46 podn. engr., engrg. divn., and at present asst. genl. supt., engrg. divn. (St.1937. Jr.1939).

References: R. K. Thoman, R. C. Flitton, A. Sankoff, G. Agar, P. W. Gooch, T. R. McLagan, C. M. McKergow.

GARCIA—ALVIN FRANCIS, of Spokane, Wash. Born at Toronto, Ont., July 11, 1916. Educ.: B.A.Sc., Toronto, 1940; with Aluminum Co. of Canada, Ltd., as follows: engrg., including supvrn. pot lining dept. and some of potrooms, Arvida, Que., 1942-43, asst. to prod. supt., La Tuque works, 1943-45, prod. supt., La Tuque, 1945-46, tech. asst. to genl. prod. supt., Arvida, Que.; with Permanent Metals Corp., Mead Works, Spokane, Wash., as follows 1946, asst. reduction plant supt., 1947 to date, reduction plant supt. (Jr.1945).

References: G. T. Malby, T. A. Carter, F. T. Boutilier, B. E. Bauman, M. L. Carey, H. A. Estabrook, A. C. Johnston.

GARGAS—JOHN, of Montreal, Que. Born at Montreal, Que., Sept. 4, 1914. Educ.: B.A.Sc., C.E., Ecole Poly., 1945; R.P.E., Quebec; 1941-42, tool engrg., Sorel Industries Ltd.; 1945-46, design engr., designing hydraulic presses, mine hoists, pressure vessels, Dominion Engineering Works; at present instructor, Canadian School of Electricity, which allows of time to pursue studies at McGill for Master degree in communications. (St.1944. Jr.1947).

References: A. Circe, I. Brouillet, J. H. Maude, R. Boucher, H. Gaudefroy, J. Pawlikowski.

GARRETT—RICHARD HUDSON, of West Vancouver, B.C. Born at Victoria, May 18, 1916. Educ.: B.Eng., McGill, 1939. 1939-40, asst. supervising engr., McKenzie River Transport; 1940-46, Pilot, R.C.A.F., for six mos. taken on strength as engr. in Test & Developm't Establishm't R.C.A.F. Rockcliffe; 1946 (2 mos.) jr. engr., Hayes Lawrence Mfg. Co., and Jan. 1947 to date, transit research asst., British Columbia Electric Rly. Co. (St.1939. Jr.1944).

References: N. C. Sherman, D. Hutchison, R. F. Legget, M. D. Berry, K. Y. Lochhead, R. Walkem, A. D. Creer, L. F. Grant.

GARRETT—CYRIL, of Saskatoon, Sask. Born at Sutherland, Sask., May 1, 1921. Educ.: B.Sc., (Engrg. Physics), Saskatchewan, 1942. R.C.A.F. radio instructor at Univ. of Saskatchewan, 1941, (5 mos.), 1942, (8 mos.); 1943, (6 mos.), research asst., National Research Council, Halifax, N.S.; 1943-45, Elect. Lieut., R.C.N., (Research Divn.), Halifax, N.S.; 1946-47, lecturer, physics dept., Univ. of Saskatchewan; and at present completing training for M.Sc., (Engrg. Physics), Univ. of Saskatchewan. (St.1940. Jr.1944).

References: N. B. Hutcheon, I. M. Fraser, W. E. Lovell, A. Michalenko, E. K. Phillips.

GENT—WILLIAM JAMES, of Montreal, Que. Born at Trinity, N'fld., Nov. 22, 1910. Educ.: B.Eng., (Elect.), Nova Scotia Tech., 1935. 1935-36, surveyor, N'fld. Gov't.; 1936-37, field engr., geophysical surveys for Hans Lundberg Ltd., Toronto, Ont.; 1938-40, power plant operator, Gander, N'fld.; 1940 to date, engrg. draftsman, elect. design, Shawinigan Engineering Co., Limited, Montreal, Que. (Jr.1940).

References: R. E. Heartz, J. A. McCrory, G. R. Rinfret, A. L. Patterson, A. B. Rogers.

GERSHFIELD—MAX, of Winnipeg, Man. Born at Winnipeg, Man., Sept. 18, 1913. Educ.: B.Sc., (Elect.), 1937. 1938-40, supt., Radio Oil Refineries, Winnipeg, Man.; 1941-43, sr. aircraft inspector, British Air Commission, Washington, D.C.; 1943-46, R.C.A.F., (aircraft inspection); 1946 to date, demolition engr., War Assets Corporation, Winnipeg, Man. (St.1937. Jr.1940).

References: W. I. Shuttleworth, J. L. Simpson, W. J. Dubesky, S. L. Becker, B. L. Phomin, E. R. Love.

GILES—JOHN OSCAR, Point Edward, Ont. Born at Sarnia, Ont., Aug. 9, 1914. Educ.: B.Sc., (Mech.), Queen's, 1937; R.P.E., Ontario. 1941-43, plant mtce. & constrn., instrument dept. head. inspr. of pressure equipment, International Petroleum Co.; with Imperial Oil Ltd. as follows: 1937-38, gen. plant experience incl. 6 mos. in instrument dept.; 1938-41, engrg. drawing; 1943-47, inspr. of high pressure equipment. (St.1937, Jr.1941).

References: G. L. Macpherson, C. P. Warkentin, D. S. Simmons, F. F. Dyer, G. W. Christie.

GIRARD—ARNOLD THOMAS, of LaTuque, Que. Born at Ottawa, Ont., Oct. 19, 1917. Educ.: B.A.Sc., Torônto, 1943; R.P.E., Quebec. 1943-44. eng. i/c air compressors, John Inglis Co., Toronto; 1944-45, Lieut., R.C.E.M.E.; 1945-46, inst. in hydraulics, Univ. of Toronto; May 1946 to date, mtce. engr., Brown Corp. Pulp & Paper Co. (Jr.1944).

References: J. M. Jopp, G. R. Lord, R. C. Wiren, E. A. Allcut, R. D. Packard.

GLANCE—EARL IRVINE, of Outremont, Que. Born at Winnipeg, Oct. 7, 1912. Educ.: B.Sc. (E.E.) Univ. of Man., 1933. R.P.E., Quebec; 1940-45, engr., T. Pringle & Son, Ltd., Montreal. At present private practice, elecl. and mech. eng., Montreal. (Jr.1940).

References: J. S. Costigan, G. M. Wynn, L. Shector, A. D. Ross, R. N. Coke.

GODDARD—ALBERT REGINALD, of Ft. Garry, Man. Born at Winnipeg, Oct. 2, 1914. Educ.: B.Sc. (C.E.) Univ. of Man., 1939. 1939-40, dftsmn. Manitoba Govt.; 1940-42, jr. asst. eng. (field) and 1942-45, asst. engr. (field), Dept. of Natl. Defence for Air; 1945-46, field engr., Ducks Unlimited, Regina; 1946 to Jan. 1947, field engr., topographical section, Dept. of Mines & Resources, Ottawa. (St.1937. Jr. 1942).

References: E. P .Fetherstonhaugh, N. M. Hall, A. E. Macdonald, W. F. Riddell, A. J. Taunton, R. W. Moffat.

GOHIER—ROCH EDOUARD, of Montreal, Que. Born at Montreal, Que., June 15, 1914. Educ.: Graduate, R.M.C., 1937; B.Eng., (Met.), McGill, 1939; R.P.E., Quebec; 1939-40, plant metallurgist, International Foils Ltd., Cap de la Madeleine, Que.; 1940-46, chief metall., Sorel Industries Ltd., Sorel, Que.; with Hydro-Quebec, as follows: 1946, (8 mos.), chemist, 1946 to date, industrial engr., industrial gas divn., Montreal, Que. (St.1937. Jr.1942).

References: P. E. Poitras, L. O'Sullivan, E. Gohier, J. C. H. Dessaulles, G. Dorais.

GORDON—HUGH JOHN, of Montreal, Que. Born at Winnipeg, Feb. 10, 1910. Educ.: B.Eng. McGill 1933; 1934-39, dftsmn., Can. Pacific Railway; 1939-40, transitman, C.P.R.; 1940-43, Lieut. 14th Fd. Coy. R.C.E.; 1943-45 Capt. 2nd Cdn. Rly. opr. R.C.E.; 1945-46, transitman, C.P.R.; 1946 to date, asst. engr., C.P.R., Montreal, Que. (St.1933. Jr.1938).

References: W. O. Cudworth, R. B. Jones, R. A. Emerson, G. B. Alexander, C. A. Colpitts, R. F. P. Bowman.

GRIMBLE—WILFRED GEORGE, of Qualicum Beach, B.C. Born at Montreal, Feb. 26, 1920. Educ.: B.A.Sc. (C.E.) Univ. of B.C., 1945; 1945 (7 mos.) jr. engr. with Dominion Water & Power Bureau, i/c of crew and cnstrn. equipment, respons. for instlln. of river gauging equipmt., etc.; Jan. 1946 to date, field engr., transmission line and station cnstrn. with British Columbia Power Comm., for H. G. Acres & Co., job engr. and area inspr., i/c all layout, inspecn. and reporting on all work by contractors. (St.1941. Jr.1946).

References: J. N. Finlayson, K. W. Morton, A. Peebles, C. E. Webb, J. L. Yuill, A. R. Moffat, T. MacIntyre.

GROLEAU—ARNOLD JOHN, of Westmount, Que. Born at Cardinal, Ont., Feb. 25, 1908. Educ.: B.Sc. (Elec.) McGill, 1928. With Bell Telephone Co. of Canada as follows: 1928-33, engr., engrg. dept.; 1933-38, engr., traffic dept.; 1938-42, traffic equipmt. engr.; 1942-47, genl. traffic engr., 1947 to date, genl. facilities supt. (St.1928. Jr.1937).

References: C. L. Brooks, R. V. MacCaulay, H. E. McCrudden, A. G. Anderson, H. F. Bush.

GROUT—RAYMOND EDWARD, of St. Lambert, Que. Born at Edmonton, Alta., Apr. 4, 1914. Educ.: B.Sc. (E.E.) Univ. of Alta., 1936. R.P.E, Quebec; 1937 to date, elecl. dftsmn. and engr., Shawinigan Engrg. Co. Ltd. (St.1936. Jr.1942).

References: J. A. McCrory, R. E. Heartz, E. V. Leipoldt, C. Lindsey, A. L. Patterson.

GRUNSTEN—ARNE WILLIAM, of Toronto, Ont. Born at Pori, Finland, Feb. 4, 1904. Educ.: B.A.Sc., Toronto, 1928; R.P.E., Ontario. With Canadian Industries Limited, as follows: 1929-38, jr. project engr., Montreal; 1939-47, sr. project engr.; at present, works engr., paint and varnish divn., York Finishes Plant, Toronto, Ont. (Jr.1928).

References: I. R. Tait, A. B. McEwen, D. A. Killam, M. S. MacGillivray, B. A. Evans.

GUNNING—MERLE PERCY, of St. Lambert, Que. Born at Coverdale, N.B., Sept. 23, 1912. Educ.: B.Eng., (Elect.), McGill, 1935; R.P.E., Quebec. 1935-36, demonstrator in descrip. geometry, McGill; 1936-37, mine work, sampling, surveying, etc., Consolidated Mining & Smelting, Montreal, Que.; 1937-39, machine shop, inspecn., Northern Electric Co., Montreal, Que.; 1939 to date, design and layout of distribution circuits (elect.), supvrn. of constrn. of underground conduits and manholes, supvrn. of instln., jointing & mtce. of underground power cables and cable accessories, dist. egrg. dept., Quebec Hydro Electric Commission, Montreal, Que. (St.1935. Jr.1940).

References: H. Millikin, R. N. Coke, S. H. Cunha, A. Benjamin, A. B. Hunt, C. V. Christie.

HALL—ALBERT HENRY, of Ottawa, Ont. Born at Edmonton, Alta., March 6, 1914. Educ.: B.Sc., (Engrg. Physics), Alberta, 1942. With National Research Council, Ottawa, as follows: 1942-45, jr. research engr., 1946, (6 mos.), asst. research engr.; and at present on leave of absence taking M.Sc., (Aeronautics) at California Institute of Technology, Pasadena, Calif., (accredited E.C.P.D.). (St.1942. Jr.1946 "A").
Lieut., R.C.C.S., instr. & administrative duties, Canada, instr.

References: J. H. Parkin, I. F. Morrison.

HALL—GORDON HUDSON, of Peterboro, Ont. Born at Peterboro, Feb. 10, 1915. Educ.: B.Sc. (Elect.), Queen's, 1939. 1939-42, regimental signals, England, brigade signal section officer & administrative duties, England; 1942-45, Capt., R.C.C.S., ch. instr. infantry signals, England; reinforcement, Sicily; officer i/c reinforcements, Sicily; Co. Commander, Sicily, Italy; June 1946 to date, engr. i/c mtce. and repair of motors and control apparatus, instlln. of light & power layouts, W. Gordon Hall, elecl. contractor. (St.1937. Jr.1945).

References: C. E. Sisson, D. V. Canning, R. L. Dobbin, D. M. Jemmett, A. L. Malby.

HAMILTON—JOHN C., of Shawinigan Falls, Que. Born at Westport, Ont., March 26, 1918. Educ.: B.Sc. (Chem. Eng.), Queen's, 1942. 1942-43, jr. chem. engr., Technical Service Dept., Canadian International Paper Co. Ltd.; 1943-Jan. 1946, shift supervisor on resin production, and Jan. 1946 to date, plant supervision i/c Vinylite Fabrication, Canadian Resins & Chemicals, Ltd. (St.1942. Jr.1944).

References: D. S. Ellis, J. S. Whyte, H. K. Wyman, C. R. Morris, R. A. Low.

HAMILTON—WILLIAM GARRISON, of Montreal, Que. Born at Pictou, N.S., Feb. 28, 1911. Educ.: B.Eng. (Mining), N.S. Tech. Coll., 1935; R.P.E. Quebec, 1935-36, asst. mining engr., Can. Johns-Manville Co.; 1936-37, assayer, Tashota Gold Field, Ltd.; 1937-38, mill supt., Lacey Gold Mine, N.S., Dept. of Labour, N.S.; 1938, mine mgr., Avon Gold Mines, Ltd.; 1938-40, surveyor, assayer, asst. mill supt., Gold Coast Main Reef Ltd., Gold Coast Colony; 1940-44, group mgr., Canadian Car Munitions Ltd., Cherrier works; 1944-45, asst. supt. operations, Defense Industries, Ltd.; 1946, engr., Foundation Co. of Canada; 1946 to date, asst. plant engr., mtce. and repair, Dominion Rubber Co. Ltd. (St.1930. Jr.1938).

References: R Ford, R. Lanctot, L. McCoy, J. T. Lang, F. H. Sexton, A. E. Cameron, F. Astels.

HAND—CARL EVERETT, of Baie Comeau, Que. Born at Blackfields, Alta., Sept. 8, 1914. Educ.: B.A.Sc., British Columbia, 1939; R.P.E., Quebec; 1939-42, Bahrein Petroleum Co., Ltd., Bahrein Islands, Persian Gulf, as follows: (18 mos.), shift operator, power house, (12 mos.), shift operator, Edeleaneau, SO2 treating plant, (12 mos.), shift operator acid treating & mfg. plants; with Aluminum Co. of Canada as follows 1943-44, shift engr., Arvida sub-station, 1944-45, supvr., meter and test de Arvida; 1945 to date, asst. supt., electrical dept., Baie Com mill, Quebec North Shore Paper Co., Ltd., Baie Comeau, Q (Jr.1944).

References: J N. Finlayson, H. J. MacLeod, F. T. Bou J. M. Pope A. Babin.

HARTLEY—ERIC LLEWELLYN, of Vancouver, B.C. Born Liverpool, England, Mar. 19, 1912. Educ.: B.Sc. (Civil) Quee 1933. R.P.E., Br. Col. 1934-36, engr., properties Dept., Richardson & Son, Winnipeg; 1936-37, W. G. Swan Engrg. Ltd., Vancouver; 1937-38, engr. i/c cnstrn., Canada Packers L Vancouver; 1937, asst. estimating engr., Western Bridge Vancouver; 1938-39, engr., B.C. Appraisal Co. Ltd.; 1938, Dom ion Bridge Co., Vancouver, erection Lions Gate Bridge; 1939 Royal Cndn. Engrs., 1939-40, Lieut., works officer, Vancou 1940-41, field engr., H.Q., 2nd Cndn. Div., 1941-42, Capt.-A 2nd Bn. R.C.E., 1942, Major O.C. B. Coy., and staff Capt. R R.C.E., 1943. Canadian War Staff course and genl. staff, N.D.B Ottawa, 1943-45, staff officer R.E. (Intelligence) H.Q. F Canadian Army; 1945-46, Western Bridge & Steel Fabricat Ltd., Vancouver, and 1946 to date, contract engr., Western Bri & Steel Fabricators. (St.1933. Jr.1946).

References: W. G. Swan, J. P. MacKenzie, S. Hogg, J. Fraser, . W. Deans, R. C. Pybus.

HARVIE—JOHN DUNCAN, of Calgary, Alta. Born at Reg Sask., Nov. 21, 1920. Educ.: B.Sc. (Civil) Univ. of Man., 1 1942-43, jr. mtce. engr., Defense Industries, Ltd., Lanscona, M 1943-45, cnstrn. engr., grade 1, on roads, bridges, bldgs., pipelines, incl. survey and design, Imperial Oil Ltd., C Project; 1945-47, res. engr., grade 3, i/c Great Bear River R cnstrn., Dom. Dept. of Public Works; at present engr., gr A, Imperial Oil Ltd., Producing Dept., Calgary, i/c bl cnstrn., design and engrg. co-ordination. (St.1941. Jr.1945).

References: P. E. Doncaster, W. J. Johnston, W. W. Ram J. E Kellett, G. H. Herriot, E. V. Gilbert, B. B. Hogarth.

HARVIE—THOMAS ALLAN, of Town of Mount Royal, Born at Montreal, Apr. 28, 1919. Educ.: B.Eng. (Mech.) Mc 1941. 1941-46, engr. officer, R.C.A.F. as follows: 1941-43, en course, Aeronautical Engrg. Sch., Montreal, Feb.-Nov. mtce. engr., No 3 B&G. Macdonald, Man., Nov. 1942-Dec. 1 developmt. engr., R.C.A.F. headquarters, Ottawa, Dec. 1943- 1944, mtce. engr., Trenton, Ont., Apr. 1944-Jan. 1946, experime and developmt. work on A/C gas turbines in U.K.; With Car air Ltd. as follows 1946 (6 most.) preliminary design engr., (4 mos.) power plant engr., 1946-May 1947, power plant de group leader, May 1947 to date, asst. i/c special design. (St. Jr.1945).

References: T W. Harvie, B. W. King, B. J. McColl, C. Crossland, E. Brown, R. E. Jamieson, G. H. deWitt, D MacCallum.

HENDRICK—MAX MORTON, of Ottawa, Ont. Born at P land, Oregon, Apr. 28, 1910. Educ.: B.Sc. (Mech.) McGill, 1933-34, research, industl. engrg. and economics McGill U 1934-35, R.C.A.F. training, Camp Borden; 1935-37, pilot signals officer, No. 2 Army Co-op. signals, Trenton; 193 specialist course Electrical & Wireless School, Cranwell Li 1940-42, No. 3 Wireless school, R.C.A.F., Winnipeg, desi conversion to war use, opened school as C.O., later ch. in 1942-44, Cndn. joint staff mission, Washington, 1944-45, A.E.A.F., HQ. signals staff and R.C.A.F. planning staff, to date, director of signals, R.C.A.F., responsible for operati efficiency of telecommunications, radar and navigational rank of Group Captain. (Jr.1945).

References: E. W. Stedman, G. O. Johnson, S. G. Tackabe A. Ferrier, A. B. Hunt, S. T. Fisher, C. A. Davidson, W. A.

HEWITT—HERBERT EUGENE of Coleman, Alta., Born at M Leod, Alta., on July 5, 1912. Educ.: B.Sc. (Civil) Alberta, 1 1935-38, engr. Mohawk Bituminous Mines, Bellevue, Alta.; 193 engr., Sudbury Hydro-Electric Commission; 1942-45, asst. e International Coal & Coke, 1945- to date, chief engr. i/c un ground constrn., outside constrn., including design of hoists. & equipment, International Coal & Coke Co. (St. Jr.1940).

References: J. A. Brusset, E. D'Appolinia, E. H. Davis, G Elkington, R. W. Brews, F. J. Hastie, H. A. Ripley, P. F. Pee

HEWITT—ROBERT, of Toronto. Born at Toronto, Ont., June 22, 1913. Educ.: B.A.Sc. (Civil), Toronto, 1935. R.P.E. Ontario; 1934, Ontario Dept. of Northern Development High Location & Surveying, Dufferin Paving Co. Ltd., Kenora; office work on building, insulation materials, Canadian Gyp Co Ltd., Toronto; 1944 doing engrg. & sales work on cons industrial, mining equipment, General Supply Co.; 1944 to vice-president, Geo. W. Crothers Ltd., Toronto. (St.1933. Jr.1

References: W. Bonn, E. R. Graydon, R. E. Hayes, R. F. Le R. S. Segsworth, R. H. Self.

HOBA—JOSEPH G., of Windsor, Ont. Born at Thorold, on Feb. 2, 1915. Educ.: B.Sc. (Mech.) Queen's 1940. R. Ontario; 1940-41, field constrn. engr., Brunner Mond Co. Amherstburg, Ont.; 1941-44, industrial engr., time study, duction routing, cost estimating, Kelsey Wheel Co. Ltd., Winc Ontario. (St.1938. Jr.1942).

References: A. D. Harris, G. W. Lusby, J. M. Wyllie, H Brunskill, W. M. Mitchell, D. C. Little.

HOBBS—DAVID H., of Arvida, Que. Born at Cleveland, Mar. 17, 1917. Educ.: B.Eng. (Chem.) McGill, 1939. R.P.E., Que 1939-40, engr. in training, Aluminum Co. of Canada, Ltd.; 19 misc. engrg. problems, 1941-42, flotation pilot plant, was plant, drying plant, 1942-43, asst. chief chemist, Demerara Ba Co.; With Aluminum Co. of Canada as follows: 1943-44, su visor of Cryolite plant, 1944-45, tech. asst. to production 1945-46, genl. tech. dept., handling economic research on processes; 1946 to date, economics of new processes in conne with power sales developmt. and promoting industrial develo of Saguenay district. (Jr.1945).

References: J. L. Connolly, F. T. Boutilier, R. Fee.

LDEN—ALEXANDER HERBERT, of Montreal, Que. Born at nto, Ont., Aug. 24, 1917. Educ.: B.A.Sc. (Chem. Engrg.) Univ. ronto, 1939; 1939-40, process devpt. engr., ammunition divn., 41, asst. chief chemist, 1941-43, ballistic engr., i/c proof, rimental and quality control on cartridge mfre., Canadian stries, Ltd., Brownsburg, Que.; 1943-45, Lieut. (E) R.C.N.V.R., vn. of water treatment (boilers) for R.C.N. ships; 1945-46, chemist, quality control of products, and 1946-Feb. 1947, a. supervisor, C.I.L. Nylon Divn., Kingston, Ont.; Mar. 1947 ite, sales engr., sales & service of boiler water condition for ec prov., E. F. Drew & Co. Ltd., Montreal. (Jr.1943).

ferences: W. J. Tomlinson, O. Holden, E. L. Johnson, J. E. a.

RSBURGH—JOHN GRAHAM, of The Pas, Man. Born at ipeg, Dec. 25, 1919. Educ.: B.Sc. (Civil Engrg.) Univ. of , 1941. May-Dec. 1941, instrmt. man. P.F.R.A., Manitoba; 45, Lieut., R.C.E.; at present, asst. hydraulic engr., Water urces Br., Dept. Mines & Natural Resources, Prov. of Mani- (St.1939. Jr.1946).

ferences: C. H. Attwood, B. B. Hogarth, A. E. Macdonald, . Herriot, W. F. Riddell.

RWOOD—WILLIAM OSMOND, of Terrebonne, Que. Born ontreal, Aug. 10, 1914. Educ.: B.Eng. (Mech.) McGill, 1937. 38, student course; 1938-39 engrg. dept., Crane Ltd.; 1939-42, igr., i/c piping and welding, Arvida; 1942-43, jr. engr., Carbon Design, Montreal; 1943-45, jr. engr., foreman i/c layout, n. and operation of magnesium foundry, Toronto, Aluminum of Canada; 1945-to date, engr. i/c design and engrg. for O. dwards Co. (affiliated) Lyman Tube & Supply Co. Ltd. 937. Jr.1943).

ferences: P. E. Poitras, A. Kirkpatrick, B. E. Bauman, M. iunders, D. C. MacCallum, C. M. McKergow, R. DeL. French.

UGHTON—JAMES SCOTT, of Montreal, Que. Born at ph, Ont., Aug. 23, 1915. Educ.: B.Eng. (Mech.) McGill, 1938; 40, dftng.; 1940-42, mech. design, Dominion Bridge Co. Ltd.; 45, aeronautical engr., R.C.A.F.; 1945 to date, mech. designer, s, hoists, hydraulic machinery, etc., Dominion Bridge Co. (St.1938. Jr.1944).

ferences: R. S. Eadie, R. H. Findlay, K. Y. Lochhead, K. O. te, W. L. Laing, C. M. McKergow.

GILL—JOHN TEMPLETON, of Montreal, Que. Born at ary, Alta., June 15, 1915. Educ.: B.Sc. (Chem. Engrg.) Univ. lta., 1939; M.Sc., (Chem. Engrg.) McGill, 1941; Ph.D. (Phys- Chem.) McGill, 1946. 1939-40, research asst., National Re- h Council; Mar.-Nov., 1941, chem. warfare Liaison Officer, Capt.; Dec. 1941-July 1943, ch. experimental officer, chem. are, Suffield, Major; 1943-45, genl. staff officer, chem. war- H.Q. First Cndn. Army, Major; at present, chem. engr., lopment & Engrg. Dept., Canadian Liquid Air Co. (St.1940. 43).

ferences: F. Keith, C. A. Robb, L. F. Grant, G. H. Griffiths, I. Hardy, J. W. Young, F. G. Kerry.

LL—ROLAND STREET, of Peterborough, Ont. Born at dstock, N.B., Mar. 29, 1909. Educ.: B.Sc. (Elec. Engrg.) N.S. Coll., 1932. R.P.E., Ontario. With Canadian General Elec- Co. Ltd. as follows: 1934-35, test course; 1935, departmental ents course, distribution transformer engrg.; 1935-36, wire cable engrg.; 1936-44, asst. engr., wire & cable engrg., dept.; 46, sr. asst. engr.; 1946 to date, managing engr., Wire & Cable (St.1931. Jr.1936).

ferences: G. R. Langley, D. V. Canning, B. I. Burgess, H. R. J. L. McKeever.

JTTON—FRANCIS SPENCE, of London, Ont. Born at Ham- Ont., Mar. 9, 1914. Educ.: B.A.Sc., Univ. of Toronto, 1936. E., Ontario; Sept. 1942-Mar. 1946, Canadian Army in Canada O/S, Lieut. and Asst. Adjt., H.Q. 1 Cndn. Rly. operating p, R.C.E.; With Canadian Natl. Rlys. as follows: 1936-38, nman, rodman, leveller; 1940-Apr. 1941, Land Surveys Dept., nto, i/c various survey parties; 1941-42, Mtce.-of-way Dept., treal, instrmt. man on track layout, estimates; Apr. 46-Aug. sst. engr., Mtce.-of-way Dept., Stratford; Aug. 1946 to date, divn. engr., London, Ont. (Jr.1938).

ferences: W. H. Kyle, W. B. Redman, T. Dembie, A. D. an, R. H. Self, J. Ferguson.

NIGAN—GEORGE GREGORY, of Montreal, Que. Born at fax, N.S., May 15, 1919. Educ.: B. Eng., N.S. Tech. Coll., 1943. E., Nova Scotia. 1943-46, engr. officer, R.C.N.V.R.; May-Sept. Naval Service, res. engr.; 1946 (2 mos.), Barrett Roofing Joliette, Que., steam plant supt.; Oct. 1946 to date, service , Combustion Engrg. Corp. (St.1943. Jr.1946).

ferences: E. C. Thomas, F. W. Gray, J. D. Kline, H. M. ile, J. G. Hall, A. E. Flynn.

FFREY—ALEXANDER, of Sarnia, Ont. Born at Tsarytsin, sia, on Jan. 30, 1918. Educ.: B.Sc. (Mech.) Queen's, 1943; mer work as follows: 1942, dftsmn. Waterous Ltd.; 1943-46, engr., designing, field engrg., St. Clair Processing Corp., ia; 1946-47, partner in firm, Coles-Jeffrey Engineering Co., ia, Ont. (Jr.1946).

ferences: F. F. Walsh, G. R. Henderson, L. A. Petrie, E. W. C. S. Phelps.

LLY—KEITH BRADEN, of Arvida, Que. Born at Arvida, il 28, 1917. Educ.: B.Sc. Acadia Univ., 1939; 1937-38 summers, ru'man., Dept. of Highways; 1940-42, dftsmn., Aluminum Co. anada Ltd., Mtl.; 1942-43, asst. resident engr., Aluminum Co. anada Ltd., Arvida, Que. (Jr.1946).

ferences: F. T. Boutilier, E. F. Hartwick, G. M. Mason, B. E. man, F. A. Dagg, J. E. Dyck.

OHNSTON—JAMES STUART, of Montreal, Que. Born at treal, Sept. 22, 1915. Educ.: B.Eng. (Mech.) McGill, 1940. E., Quebec; 1939 to date, with Dominion Oxygen Co. Ltd. as ows: 1939-42, engrg. sales, 1942-43, process service engr., 6 mos. Newark dvlpmt. lab. on design and dvlpmt. of oxy-acetylene cess equipment and 5 mos. in Algoma Steel on installn. of ve, 1943-45, service engr., Montreal and Toronto, i/c design of gen and acetylene piping distribution systems, acetylene generation instllns., etc., 1945-47, field engr., Montreal, as above plus "Cascade" and "Driox" oxygen instlln. design. (Jr.1944).

References: D. S. Lloyd, W. A. Duncan, J. W. Ross, E. V. Gage, L. Jehu.

KAUTH—CARL GLADSTONE, of Toronto, Ont. Born at Naperville, Ill., Aug. 19, 1919. Educ.: B.Sc. (Elec. Engrg.) Queen's, 1934. With Dominion Oxygen Co. Ltd. as follows: 1935-38, hydrostatic tester, repairman, pumper and operator; Jan.-Aug. 1939, asst. plant supt., Sault Ste. Marie; 1939-41, asst. plant supt., Toronto; 1941-42, asst. plant supt., Montreal; 1942-46, plant supt., Welland, and June, 1946, to date, plant supt., Toronto. (St.1934. Jr.1937).

References: W. A. Duncan, D. S. Lloyd, W. D. Brownlee, N. K. Cameron, D. S. Ellis.

KAZAKOFF—JOHN, of Montreal. Born at Kamsack, Sask., on March 14, 1913. Educ.: B.Eng., (Elect.), McGill, 1935; R.P.E., Quebec; 1935-38, design dftg., Canadian Ingersoll Rand Co. Ltd.; with Bolivian Power Co. Ltd., La Paz as follows: 1935, design dftg.; 1938, constrn. engr.; 1939, asst. supt.; 1940, supt; 1942 to date, asst. supervisor, Southern Properties, Montreal Engineering Co. Ltd. (St.1935. Jr.1940).

References: G. H. Thompson, J. H. McLaren, J. K. Sexton, J. T. Farmer, A. C. D. Blanchard.

KEIL—HUGH DOUGLAS, of Windsor, Ont. Born at Brock, Sask., Mar. 1, 1915. Educ.: B.A.Sc., (Univ. of B.C.) 1937. R.P.E., Ontario. 1937-40, engrg. apprentice course, Cndn. Westinghouse Co.; 1940-46, electl. engr., and 1946 to date, asst. mtce. supervisor, Windsor Salt & Alkali plant of Canadian Industries Ltd., Windsor. (Jr.1943).

References: H. L. Johnston, A. D. Harris, G. W. Lusby, W. R. Mitchell, F. J. Ryder.

KELBY—JAMES OSWALD, of Ottawa, Ont. Born at Deseronto, Ont., Aug. 27, 1915. Educ.: B.Eng. (Chem.) McGill, 1941. R.P.E., Ontario; May-Dec. 1941, shift engr., synthetic anhydride plant, Can. Celane Corp., Drummondville, Que.; 1941-43 dvlpmt. engr., Dominion Rubber Co., Montreal; 1943 to date, Canadian Active Army, R.C.E.M.E., as Lieut.; 1943-46, dvlpmt. engr. in chem. warfare; 1946 (3 mos.) O.M.E. at No. 10 Coy., Longue Pointe; Sept. 46 to date, tech. officer, F.B.C. (St. 1940. Jr.1943).

References: A. P. Benoit, R. Ford, J. B. Phillips, P. B. French, W. T. Doran, G. L. Wiggs.

KENT—ALLAN DOUGLAS, of Quarries P.O. (Ottawa), Ont. Born at Halifax, N.S., Jan. 13, 1915. Educ.: B.Sc., Queen's, 1936. 1936 (4mos.) mech. engr., Gilson Mfg. Co., Guelph, Ont.; 1936-38, mech. engr., General Steel Wares, London, Ont.; 1938-40, sales engr., Sheldons Ltd., Galt, Ont.; 1940-41, lecturer and demonstrator, Queen's Univ.; 1941-45, mech. engr., Aluminum Co. of Canada, Arvida, Que.; 1945-46, asst. research engr., and at present asst. research engr., Divn of Physics and Electl. Engrg., National Research Council, Ottawa. (St.1935. Jr.1942).

References: M. G. Saunders, R. H. Rimmer, H. J. Simmons, J. H. Parkin, R. F. Legget.

KERR—JAMES WINSLOW, of Hamilton, Ont. Born at Hamilton, Mar. 11, 1914. Educ.: B.A.Sc., Toronto, 1937. 1942-45, Squadron Leader i/c electl. inspn., R.C.A.F. Aeronautical Inspn. Divn.; with Canadian Westinghouse Co. Ltd. as follows: 1937-38, apprentice engrg. course, 1938-39, correspondent, 1939-41, sales engr., 1945-47, central station sales divn., and 1947 to date, asst. mgr., central station sales divn., involved in application of transformers, switchgear and large waterwheel generators. (Jr.1938).

References: H. A. Cooch, J. R. Dunbar, E. E. Orlando, A. A. Moline, L. C. Sentance, D. W. Callander, K. W. Fraser.

KING—CAMERON NORCOTT, of Montreal, Que. Born at Plaster Rock, N.B., Mar. 21, 1915. Educ.: B.Sc. (Civil Engrg.) Univ. of N.B., 1936. R.P.E., Quebec; 1937-40, instrmtman. Dept. of Public Works, N.B.; 1940-46, dftsmn., genl. engrg. dept., Aluminum Co. of Canada; at present, asst. engr., Canadian Pacific Rly. (Jr.1940).

References: J. E. Armstrong, W. G. Dyer, C. Neufeld, G. E. Shaw, W. L. Pugh.

KING—HECTOR IRONS, of Montreal, Que. Born at Perth, N.B., March 3, 1916. Educ.: B.Sc., (Civil), New Brunswick, 1937; 1937-39, asst. pur. agt., Bathurst Power & Paper Co., Bathurst, N.B.; 1940-41, jr. engr., Saguenay Power Co., Arvida, Que.; 1941, engr., A. Janin & Co., Montreal; 1941 to date, (with exception of period 1943-45, Lieut., R.C.E.), engr., design and estimating, Truscon Steel Co. of Canada Ltd., Montreal, Que. (St.1938. Jr.1939).

References: F. R. Murray, R. R. Willis, A. Olsen, S. M. Sproule, R. E. Jamieson, G. J. Dodd, G. A. Campbell.

KIRKPATRICK—ROBERT EVANS, of Grand'Mere, Que. Born at Montreal, Que., May 4, 1914. Educ.: B.Eng., (Mech.), McGill, 1937; 1933-38, (summers), prod. control, Dominion Engrg.; 1938-40, prod. & design, B. J. Coughlin Co.; 1940-41, Seconded from Royal Cdn. Artillery to English Army for munition design, Woolwich Arsenal; 1941, inspecn. of propellants & cartridges, Inspectn. Board of U.K. & Canada, Ottawa; 1943-44, C.M.H.Q., London, attached to English Projectile Develop't. Estb. as rocket design engr.; 1945, survey reporting on German industry; 1946, discharged from Army with rank of Major; at present, mech. engr., design of wood handling plants, Consolidated Paper Corp. Ltd., Grand'Mere, Que. (St.1937. Jr.1942).

References: F. W. Bradshaw, R. DeL. French, H. O. Keay, T. C. McConkey, J. G. Notman, E. F. Viberg.

KLODNISKI—NICHOLAS ALBERT, of Montreal, Que. Born at Edson, Alta., Feb. 13, 1915. Educ.: B.Sc., (Elect.), Alberta, 1937; R.P.E., Quebec; 1937-40, electrician International Nickel Co. of Canada, Ltd., Copper Cliff; 1940-41, elect. foreman, H. F. McLean Ltd., Valleyfield, Que.; with Canadian National Railways, as follows: 1941-42, engrg. dftsman., design, layout, inspecn. elect. work, Central Station, Montreal; 1942-46, design, layout, inspecn. elect. instllns., architectural dept., 1946 to date, elect. asst., Montreal, Que. (St.1937. Jr.1943).

References: H. F. Finnemore, N. S. B. Watson, P. L. Matheson, J. D. Sylvester, R. B. Killam, H. G. Worley.

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References: J. B. Angel, E. Dickinson, E. Hinton, G. R. Jack, J. W. Morris, W. D. G. Stratton.

KOSNAR—VINCENT GEORGE, of Hull, Que. Born at Sutherland, Sask., Sept. 15, 1912. Educ.: B.Eng., (Elect.), McGill, 1938; R.P.E., Quebec; 1938-39, asst. plant engr., Montreal Light Heat & Power; 1940-42, asst. elect. engr., supervn. elect. equipt. for new constrn. & mtce. at oil refinery, Trinidad Leaseholds Ltd., Trinidad, B.W.I.; 1942-46, elect. design for lighting power instlns., etc., Dept. of National Defence; at present, elect. engr. i/c elect. work, engrg. & constrn. service, etc., Dept. of Mines & Resources, Ottawa, Ont. (St.1937. Jr.1946).

References: T. S. Mills, J. N. Stinson, G. Rankin, C. V. Christie, C. J. Mackenzie.

LAARI—WILLIAM, of Toronto, Ont. Born at Toronto, Ont., Jan. 15, 1917. Educ.: B.A.Sc., Toronto, 1939; R.P.E., Ontario; 1939-41, jr. engr., transmission sect., H.E.P.C. of Ontario; 1941-42, demonstrator, Dept. of Mech., Engrg., Univ. of Toronto; with Canadian Allis-Chalmers Ltd., as follows: (with exception of period 1943-45, R.C.A.F., as P/O), 1942-43, field engr., Shipshaw, 1945-46, hyd. engr.; and at present, lecturer, Dept. of Mech. Engr., Univ. of Toronto, Ont. (Jr.1942).

References: C. R. Young, R. C. Wiren, G. R. Lord, J. J. Trail, J. A. Aeberli.

LABERGE—PAUL X., of La Malbaie, Que. Born at Montreal, Que., May 24, 1918. Educ.: B.A.Sc., C.E., Ecole Poly., 1942; R.P.E., Quebec; 1942-43, jr. engr., Brown Corporation; constrn. of recovery furnace, genl. work in plant; 1943 to date, plant engr., full responsibility mill improvements; constrn. modern grinder room, paper machine improvements, Harland drive, etc., Donohue Brothers Pulp & Paper Mill, La Malbaie, Que. (St. 1940. Jr.1944).

References: J. Stadler, A. T. Hurter, R. D. Packard, A. Circe, H. Gaudefroy, Y. Tasse.

LAMARCHE—MARCEL, of Montreal, Que. Born at St. Neuri de Mascouche, Que., Feb. 11, 1917. Educ.: B.A.Sc., C.E., Ecole Poly., 1940; R.P.E., Quebec; 1940-42, asst. to chief logging engr., Price Bros. & Co., Ltd., Chicoutimi, Que., with Canadian Fairbanks Morse, as follows: engr. i/c hull constrn. and mech instln. on minesweepers, 1945, sales engr.; at present, sec.-treas., Beaudry, Gerin & Lamarche, engrs. & builders, Montreal, Que. (St.1937. Jr.1944).

Rferences: M. Gerin, P. F. Beaudry, A. Duperron, J. A. Lalonde.

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References: J. R. Wood, J. I. Strong, W. L. Foss, S. H. Hawkins, R. A. McLellan, E. K. Phillips.

LANCEFIELD—HAROLD ALLAN, of Port Hope, Ont. Born at Calgary, Alta., Jan. 21, 1916. Educ.: B.Sc. (Mech.), Saskatchewan, 1939; R.P.E., Ontario; 1939-40, appraiser, Dominion Appraisal Co., Toronto; with Alliance Paper Mills, Merritton, Ont., as follows: 1940-41, plant mtce., 1941-42, asst. to mtce. engr.; 1942, project engr., Canadian Industries Ltd.; R.C.A.F., as follows: 1942-43, Engrg. Officer, O.C. hydraulic equipt., repair shop, etc., Trenton, Ont., 1943-45, modification develop't. & mtce., H.Q., Ottawa, with rank of F/O; 1945 to date, detail engr., Mathews Conveyor Co., Port Hope, Ont. (St.1939. Jr.1943).

References: E. M. Wynn, B. H. Russell, H. L. Johnston, A. H. Pask, P. O. M. Erickson.

LAPOINTE—GERARD A., of Montreal. Born at Montreal on April 30, 1912. Educ.: B.A.Sc. (Civil), 1938, Ecole Polytechnique; R.P.E., Quebec; 1938-41, hydraulic design engr., City of Montreal, Sewers Commission; 1941-43, refinery designer; 1943-45, constrn. engr., McColl Frontenac Oil Co. Ltd.; 1945-46, consulting engr.; 1946-47, asst. to Mr. J. Greber, public works, National Capitol Planning Service; at present with consulting engrs. Lapointe & Dery, Montreal. (St.1936. Jr.1940).

Refernces: P. deGuise, J. Dery, L. Trudel, C. E. Gelinas, J. Laurence.

LAUGHLAN—STANLEY COLIN, of Vancouver, B.C. Born at Revelstoke, B.C., Feb. 11, 1916. Educ.: 1937-39, Indiana Tech. Coll., Fort Wayne, Indiana; 1935 & 1936, (summers), rodman, Canadian Pacific Rly., Revelstoke, B.C.; 1940, (4 mos.), axeman, Stewart & Welch, Bloedel, B.C.; with Canadian Pacific Rly., as follows: 1940-46, transitman, Regina, Sask.; 1946 to date, transitman, Vancouver, B.C. (Jr.1941).

References: G. B. Alexander, C. A. Colpitts, S. T. Lewis, F. W. Alexander, R. A. Emerson.

LAYTON—MICHAEL SHAKESPEAR, of Montreal. Born at Bury St. Edmunds, England. Educ.: B.Eng., 1935, McGill; 1935-40, research & production of elect. welding wire, Steel Company of Canada Ltd.; 1940-45, navigator, R.C.A.F.; 1945, asst. to vice president; 1947, asst. works mgr., Steel Company of Canada Ltd. (Jr.1938).

References: H. M. Jaquays, R. S. Eadie, E. C. Kirkpatrick, P. E. Poitras, A. B. Dove.

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References: P. B. French, R. D. French, D. Giles, A. G. Christie, A. P. Benoit, D. P. MacNeil.

LeBEL—RAYMOND, of Montreal, Que. Born at Montreal, Q… Dec. 18, 1912. Educ.: B.A.Sc., C.E., Ecole Poly., 1939; R.P.E. Quebec; 1933-34-35 & '38, (summers), chainman, rodman, le… man, transitman, Quebec Streams Commission; 1939-40, design dftng., supvrn. of retaining wall, etc., Public Works, federal 1940-42, structl. engr., design of concrete constrn., supvrn work in field; J. H. Eug. Guay, consultg. engr.; 1942-46, R.C.E. rank of Lieut.; 1946 to date, structl. engr., J. H. Eug. Guay, Montreal Que. (St.1938. Jr.1940).

References: P. Bastien, E. W. Turcke, H. Guadefroy, C… Hebert, L. Trudel, J. C. Chagnon.

LEROUX—GEORGE GUSTAVE, of Montreal. Born at Montre… on Feb. 10, 1915. Educ.: B.Eng., (Civil), McGill, 1940; R.P.E. … Quebec, summer work as follows: 1937, McIntyre Porcupine Go… Mines; 1938, Siscoe Gold Mines; 1939, Department of Transport Civil Aviation Division; 1940-45, Royal Canadian Air Force; 194… to date, engr., Foundation Company of Canada, Montreal. (St.19… Jr.1942).

References: R. E. Chadwick, W. Griesbach, B. Griesbach, … Lamb, R. J. Doehler, R. DeL. French.

LEVINE—SAMUEL DAVE, of Buffalo, N.Y. Born at Selk… Man., on May 28, 1913. Educ.: B.A. Sc. (chem.) 1939, Toronto 1939-40, research asst., Maxol Petroleum Corp., North Tonowand… N.Y.; 1940-43, examiner of materials, Inspection Board of th… United Kingdom of Canada; 1944-45, processing engr., Metal Disintegrating Co. Inc., Elizabeth, N.J.; 1945-46, technical advis… Linde Air Products Co.; 1946 to date, i/c production, planning control at Harris Soap Div., Hygrade Foods Inc. Buffalo, N… (St.1937. Jr.1942).

References: C. R. Young, J. J. Spence, W. S. Wilson, J … Cockburn.

LEWIS—CROMPTON EMERSON, of Toronto. Born at Bar… Ont., on March 16, 1915. Educ.: B.A.Sc., Toronto, 1936; wi… Canadian General Electric Company as follows: 1936-37, te… course; 1937-38, engrg. dept., Peterboro; 1938-39, apparatus dept 1939-40, apparatus engr., Edmonton office; 1940-41, apparatus div Calgary office; 1942-43, tool design dept., 1943-44, general supt' office, Davenport Works; 1944-45, co-ordinating supt., Aircra… Tank Dept.; 1945-46, supt., transformer parts dept., Davenpo… Works, Toronto. (St.1937. Jr.1946).

References: C. E. Sisson, G. R. Langley, E. A. Allcut … Norman.

LEWIS—DONALD WILFRED JAMES, of Arvida, Que. Bor… at Riga, Latvia, Oct. 15, 1913. Educ.: B.A.Sc., Toronto, 19… 1938-42, chemist, and from 1940, mgr., L. J. McGuinness & C… Ltd., Mimico, Ont.; with Aluminum Co., of Canada, Arvida … follows: 1942-45, asst. supvr., Bayer ore plant; 1945-46, asst. supv… fluoride plant; 1946 to date, develop't. engr., Bayer ore plan… fluoride plant divn. (Jr.1945).

Referencese: J. E. Dyck, D. F. Nasmith, A. F. Johnston, J. Braun F. A. Dagg.

LOGIE—WILLIAM ALEXANDER, of Toronto, Ont. Born … Toronto, Ont., Dec. 31, 1916. Educ.: B.Sc., (Elect.), New Brun… wick, 1938; with Quebec Hydro Commission, as follows: 1938-4… jr. Engr., elect. dist. dept., (Montreal, Light, Heat & Pow… Cons.); 1943-46, engr., relay dept., 1946 to date, elect. dftsm… H.E.P.C. of Ontario, Toronto, Ont. (St. 1938. Jr.1945).

References: W. E. Seeley, A. Benjamin, F. W. Hubbard, H. … Haberl, R. W. Farmer, R. M. Walker, E. R. Logie.

LOISELLE—JOHN CHESTER, of Montreal, Que. Born at M…real, Que., Nov. 18, 1913. Educ.: B.Eng., (Civil), McGill, 19… 1941-42 (9 mos.), engrg. staff, Canadian International Paper C… Gatineau, Que.; 1942-44, asst. res. engr., Ministry of Aircra… Production, London, England; 1944-45, prod. engr., Canadi… Marconi Co.; 1946 to date, asst. engr., A. F. Byers Constructi… Co., Ltd., Montreal, Que. (St.1936. Jr.1946).

References: E. V. Gage, B. R. Perry, H. W. Lea, G. L. Pl… R. H. Mather, I. Brouillet.

LOOMIS—JAMES GORDON MANN, of Montreal, Que. Born … Montreal, Que., March 14, 1912. Educ.: B.Eng., (Mech.), McGi… 1936; R.P.E., Quebec; 1932-36 (summers), asst. engr. on ro… constrn. work for Bitumen Products Corporation; 1936-39, as… engr., full time, estimating, plant mtce. and mfg. asphaltic emu… sions (same company); 1939-40, engr., jigs and tool design dep… 1940-41, jr. engr., pulp and paper mill, Canadian Int. Paper C… 1941-45, R.C.A.F., Aero. Engr., with rank of S/L; 1945 to da… engr., Construction Equipment Co., Ltd., Montreal. Que. (St.19… Jr.1941).

References: A. R. Chadwick, W. Griesbach, P. Hall, J. T. Lar… R. F. Shaw, J. R. Mills.

LUCYK—JOHN WASYL, 77 Park Row S., Hamilton, Ont. Bo… at Krydor, Sask., Dec. 2, 1914. Educ.: B.Sc., (Elec.), Man., 19… R.P.E. Ontario; 1937-40, post graduate ap'ticeship, Gen. Elec. C… Birmingham, England; 1941, demonstrator, elec. engrg., Univ. … Man.; 1941, dftsmn., Hamilton Bridge Company; 1942 to da… asst. chief engr., Aerovox Canada Ltd., Hamilton, Ont. (Jr.194…

References: E. P. Fetherstonhaugh, L. C. Sentance, T. J. Boy… N. M. Hall.

MADILL—JOSEPH TINDALE, of Arvida, Que. Born at E… monton, Alta., Sept. 30, 1917. Educ.: B.Sc, (Elect.), Alberta, 19… S.M., (Elect.), M.I.T., 1940; R.P.E., Quebec; 1940-41, memb… System Studies Group, design and appraisal divn., EBAS… Services Inc., New York; with Saguenay Power Co., Ltd., … follows: 1941, (3 mos.), genl. elect. work, 1941-42, asst. pr… tection engr., genl. system problems, 1942-44, system protect… engr., (Saguenay Transmission Co., later Aluminum Co., Shi… shaw), responsible for relaying, metering & test work on Syste… 1944 to date, elect. engr., responsible for work of syste… protection engr., elect. mtce. and engrg. at Shipshaw and Chut… a-Caron stations and all sub-stations except Arvida, Alumin… Co. of Canada, Ltd., Shipshaw, Que. (St.1940. Jr.1941).

References: McN. DuBose, F. L. Lawton, A. C. Johnston, J. Ward, W. Fraser, J. E. Thicke.

MALBY—GEORGE THOMAS, of 846-7th St., Arvida, Q… Born at Winnipeg, July 10, 1911. Educ.: B.Sc., (Civil), Ma… 1935; R.P.E., Quebec; 1935 (Aug.-Nov.), inspr., Man. Good Roa… Dept.; 1936-37, engrg. mapper, Dept. Geology & Topograph…

va; 1937-39, engr. on design, constrn. & surveys, Saguenay
r Co.; with Aluminum Co. of Canada as follows: 1939,
rn. engr., 1939-40, engr. on design, 1940-42, asst. res. engr.,
(Mar.-July), res. engr. i/c constrn. at Shawinigan Falls;
44, res. engr. i/c constrn. La Tuque plant, also mech. supt.;
to date, asst. mech. supt. i/c all bldg. & plant mtce., Arvida
ts. (Jr.1938).

ferences: C. Miller, M. G. Saunders, W. L. Pugh, J. W.
l, B. E. Bauman.

NN—O. NELSON, of Toronto. Born at Sydney, N.S., on
8, 1912. Educ.: B.Eng., Nova Scotia Technical College, 1935;
37, lab. technician & asst. meter engr., Imperial Oil Ltd.,
nouth, N.S.; 1937-40, plant supt. Eagle Pencil Co., Drum-
lville, Que.; with Defence Industries Limited as follows:
41, shift supervisor, Brownsburg; 1941-42, supervisor, Cart-
Case Prod., Verdun; 1942-45, process engr.; 1945-46, time
eng., J. D. Woods & Gordon Ltd.; 1946-47, production
Galt Metal Industries Ltd., Galt, Ont. (St.1936. Jr.1937).

ferences: F. H. Sexton, C. H. Jackson, H. B. Hanna, R. E. L.
son, I. R. Tait, A. P. Boutilier.

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ill, 1938; R.P.E., Quebec; with British American Oil Co. as
ws: 1938-40, asst. chemist, 1940-42, process engr., 1942-46,
refinery inspr., 1946 to date, resident refinery engr., Mont-
(St.1938, Jr.1941).

ferences: W. E. Lundie, R. F. A. Smith, E. C. Hurd.

LDRUM—ALAN HAYWARD, of Norman, Okla. Born at
bridge, Alta., May 24. 1913. Educ.: B.Sc., (Chem. Engrg.),
rta, 1938; B.Sc., Univ. of Oklahoma, 1945-47 (accredited
.D.); 1938-44, chemist Algoma Steel Corp.; 1944-45, chemist,
sh American Oil Co.; 1946, engr., Stanolind Oil and Gas
graduate student, Univ. of Oklahoma). Jr.1938).

ferences: A. E. Pickering, C. Stenbol, G. W. Holder, W. D.
ns, LeR. Brown, J. L. Lang, K. G. Ross.

NDELSOHN—ALBERT, Major, of Kingston, Ont. Born at
real, Que., March 21, 1917. Educ.: B.Eng., (Mech.), McGill
., 1939; 1939-40, (16 mos.), fuel engr., Algoma Steel Corp.,
R.C.E.M.E., as follows: 1940-41, England, 1944, N.W. Europe,
ned to Canada, 1945; during period, in command various
.M.E. units, responsible for repair modification & mtce.
l equipt. in various Army units; last position A/Comd. 3
Inf. Div.; at present, completing course at Canadian Staff
ge, Kingston, Ont. (St.1937. Jr.1946).

ferences: G. H. Spencer, K. H. McKibbin, W. S. Hunt,
. Conn, D. H. Rochester, S. Slater.

RCIER—JULES, of Quebec City. Born at Trois Rivieres
Feb. 12, 1915. Educ.: B.A.Sc. (Civil), Ecole Polytechnique,
R.P.E., Quebec; with Canadian General Electric Co. as
ws: 1940-41, test course; 1941-43, Meter & Aircraft Instru-
s Engrg.; 1943-44, Commercial Dept., distribution equipment
on—Toronto; 1944 to date, sales engr., i/c distribution
pment to electrical utilities, sales of wiring materials, in-
rial heating and specialties, Quebec district. (St.1938. Jr.1943).

ferences: P. A. Dupuis, L. Beaudry, R. Dupuis, G. R.
ley, J. S. Keenan.

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erford, N.S., Oct. 3, 1912. Educ.: B.Sc. (Civil), 1934, B.Eng.
h.), 1935, N.S. Tech. Coll.; 1935-36, instrumentman, 1936-37,
engr., N.S. Dept. of Highways; 1937-38, field engr. & supt.,
erin Paving Ltd.; 1939 to date, engr. on open hearth furnace
trn., plate mill rehabilitation, gen. steel plant engrg., and at
ent chief dftsman., iron & steel divn., Dominion Steel &
Corpn., Sydney River, N.S. (St.1935. Jr. 1941).

ferences: W. S. Wilson, J. A. MacLeod, C. M. Anson, J. F.
nis, F. H. Sexton.

LLER—CHARLES ARTHUR, of Montreal, Que. Born at
nto, Ont., March 24, 1915. Educ.: B.A.Sc., Toronto, 1936;
E., Ontario; with Canadian Industries Limited, as follows:
40, dftng., design and determination of material requirements
cellophane machine, etc., engr. on acid plant design; 1940,
sferred to D.I.L., first as engr., acid plant design, field engr.,
trn. Nobel works, DeSalaberry works, Valleyfield, Winnipeg
s; 1941, asst. supt., acid plant, Winnipeg, 1942, supt., Winni-
1943, supt. Guncotton plant, Winnipeg; 1944, supt., Guncot-
plant, Nobel; 1945 to date, project engr. on design of atomic
lop.'t. plant, Chalk River, Ont. (for National Research
ncil). (Jr.1938).

ferences: E. B. Jubien, C. H. Jackson, A. B. McEwen, I. R.
H. C. Karn, E. A. Allcut.

LLER—ERROL LESLIE, of Pietermaritzburg, Natal, S.A.
at Ottawa, Ont., Feb. 12, 1912. Educ.: B.Eng., (Civil),
ill, 1936; 1936, Geological Survey of Canada; 1936-39, Cana-
Johns Manville Co., as chief sales clerk; 1939-40, asst. res.
., City of Westmount; 1940-41, project engr., later project
., J. L. E. Price Construction Co., Montreal; with Aluminum
of Canada, as follows: 1941-43, i/c engrg. design, Demerara
xite Co., 1943-44, res. engr., Arvida, Que., 1944-45, asst. res.
., Aluminum Power Co., Shipshaw, Que., 1945-46, i/c of
., Jamaica Bauxite Co., 1946 to date, res. engr., Aluminum
of South Africa. (St.1936. Jr.1940).

ferences: J. C. Batzold, M. P. Weigel, P. G. Delgado, C.
ds, M. Hornback, C. Miller.

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inspr., Robert Mitchell Company; 1943-46, E.M.E., in
E.M.E.; 1946 to date, mfg. methods engr., Northern Electric
Ltd., Montreal. (St.1940, Jr.1946).

eferences: C. A. Peachey, J. E. Armstrong, H. C. Spencer,
A. Goldman, J. A. Coote, C. M. McKergow.

ILNE—JOHN REID, of Spring Coulee, Alta. Born at Lashburn,
.; on Oct. 19, 1922. Educ.: B.E., (Civil), Saskatchewan, 1944;
summer, chainman, public roads administration on Alaska
Highway; 1945-46, Jr. hydraulic engr., P.F.R.A., i/c surveys on Qu'Appelle Valley; 1946 to date, Jr. Hydraulic Engr. on constrn. of St. Mary Dam near Spring Coulee, Alta. (Jr.1944).

References: G. L. McKenzie, W. L. Foss, J. G. Watson, E. K. Phillips, C. R. Forsberg.

MOLLAND—FREREDICK WILLIAM, 1501 W. First St., Marion, Indiana. Born at Thorndale, Ont., March 24, 1915. Educ.: B.Sc. (Mech.), Queen's, 1937; With Paranite Wire and Cable Corpn. as follows: 1937-39, engr. designing machy., plant layouts, elec. layouts, Jonesboro; 1939-40, plant engr., setting up new plant, Marion; 1940-45, plant engr. & supt. of mtce., Paranite Wire & Cable Divn., Essen Wire Corporation; 1945 to date, plant engr., also consltg. engr. for several divns. of Essen Wire Corpn. (St.1937. Jr.1946).

References: D. S. Ellis, A. Jackson, L. T. Rutledge, R. A. Low, E. V. Briceland.

MOORE—REGINALD ARTHUR, of St. Catharines, Ont. Born at South Moulton, Eng., Feb. 23, 1897. Educ.: B.Sc., (Elect.), McGill, 1923; R.P.E., Ontario; 1923, assembler, transformers & motors, English Electric Co. of Canada, Ltd.; 1923-24, dftsman., sub-stn. design, H.E.P.C. of Ontario; 1924-25, dftsman. & jr. engr., power house sub-stn: trans. line design, Herdt & Burr, consultg. engrs.; 1925-26, demonstrator, elect. engrg. dept., McGill Univ.; 1926-32, elect. design engr., Shawinigan Engineering Co., Ltd., Montreal; with English Electric Co. of Canada, Ltd., as follows: 1934-35, design engr.; 1935 to date, chief engr., switchgear divn., St. Catharines, Ont. (St.1921. Jr.1926).

References: E. V. Leipoldt, R. E. Heartz, A. J. Bennett, R. A. C. Coombes, G. Morrison, D. Ramsdale, I. S. Patterson.

MORRIS—ROBERT McCAUL, 41 Union St., Ottawa, Ont. Born at Trenton, N.S., Sept. 20, 1915. Educ.: B. Eng., N.S. Tech. Coll., 1940; 1940-41, elec. dftsman., Shawinigan Engineering Company; 1941-46, junior research engr., Jan. 1946 to date, asst. research engr., National Research Council, Ottawa, Ont. (St.1940. Jr.1943).

References: B. G. Ballard, D. S. Smith, H. W. McKiel, F. H. Sexton, W. R. McCaffrey.

MORRIS—RONALD WILLIAM, of Winnipeg, Man. Born at Winnipeg, Man., Dec. 12, 1917. Educ.: B.Sc., (Elect.), Manitoba, 1940; 1938, (summer), instru'man., Winnipeg Engrg. Dept.; 1939, (summer), dftsman., Anthes Foundry Ltd., Winnipeg; 1940-45, R.C.E.M.E., with rank of Captain; 1945-47, project engr., design & develop't. of ground & servicing equipt., engrg. dept., Trans Canada Airlines, Winnipeg, Man.; at present, asst. supt., Anthes Foundry Ltd., Winnipeg, Man. (St.1939. Jr.1945).

References: W. J. D. Cameron, J. T. Dyment, E. P. Fetherstonhaugh, N. M. Hall, G. H. Herriot, J. M. Lupton.

MOULE—GERALD WILLIAM, of St. James, Man. Born at Luton, England on March 23, 1915. Educ.: B.Sc. (Elect.) Manitoba, 1937; with Canadian Industries Ltd. as follows: 1937-40, elect. dftg.; 1940-41, jr. elect. engr.; 1941-42, supervisor in Cordite Dept., Winnipeg; 1942-45, Jr. elect. engr., Montreal; 1945 to date, elect. design engr., City of Winnipeg Hydro Electric System. (St.1935. Jr.1943).

References: H. C. Karn, A. G. Moore, H. L. Briggs, T. E. Storey, D. Hunter.

MULLINS—HARRISON ALEXANDER, of Montreal, Que. Born at Herschel, Sask., Nov 23, 1912. Educ.: B.Sc., (Elect.), Manitoba, 1937; 1937, dtfsman., Eastern Power Devices, Toronto; 1937-38, shop course, Maloney Electric Co., Toronto, 1938-39, chief engr., Taylor Electric Mfg. Co., London, Ont.; 1939-40, elect. engr., Imperial Tobacco Co., Montreal; 1940 to date, project engr., Canadian Industries Limited, Montreal, Que. (St.1937. Jr.1942).

References: M. S. Macgillivray, C. H. Jackson, D. A. Killam, A. McEwan, I. R. Tait, E. Jubien.

MURPHY—BERNARD ROSS, 36 Cheltenham Ave., Toronto 12, Ont. Born at Toronto, Oct. 1, 1919. Educ.: B.A.Sc. (Mech.), Toronto, 1941; R.P.E., Ontario; 1941 to date, junior design engr., H.E.P.C. of Ontario, Toronto, Ont. (Jr.1946).

References: I. S. Widdifield, R. H. Self, T. Dembie, G. R. Lord, C. R. Young, E. R. Graydon.

MURRAY—JAMES ALBERT, 6 Heathbridge Park, Toronto, Ont. Born at Toronto, July 2nd, 1919. Educ.: B.Arch., Univ. of Toronto, 1943; Member, R.A.I.C.; 1942-45, timber design, for C. F. Morrison, M.E.I.C.; 1943-44, i/c dfting. room, City Planning Board, Toronto; 1944-45, on the staff, and 1945 to date, lecturer, School of Architecture, Univ. of Toronto, also 1945 to date, partner in arch'l. firm, Cameron Murray & Fairfield, Toronto, Ont. (St.1943. Jr.1945).

References: C. F. Morrison, A. E. K. Bunnell, S. H. DeJong, C. R. Young, J. M. Millman, A. E. LePan.

MYERS—GORDON ALEXANDER, of Clarenville, Nfld. Born at Bay Roberts, Nfld., April 19, 1915. Educ.: B.Eng., (Elect.), Nova Scotia Tech., 1936; R.P.E., Nova Scotia; 1936, (3 mos.), asphalt road paving inspectr., Milton Hersey Co., Montreal; 1936, (3 mos.), surveyor, Nfld. Gov't.; 1936-37, radio repairs and sales, (own business); 1937, (4 mos.), chemist, Colas Nfld. Ltd.; 1937-38, electrician, Nfld. Gov't.; 1938, (7 mos.), chief chemist, Colas Nfld. Ltd.; 1938-39, electrician, Nfld. Gov't., (Gander Airport); 1939-40, (5 mos.), radio repairman; 1940-42, asst. plant mgr., Colas Nfld. Ltd.; 1942 to date, supt., mfg. asphalt emulsions for airport and highway paving, creosoting of rly. ties, poles and wharf piling, The Flintkote Co. (Nfld.), Ltd., Clarenville, Nfld. (St.1937. Jr.1941).

References: W. H. Ackhurst, J. B. Angel, A. R. Harrington, A. Hopkins, S. Ball, G. H. Burchill.

MacBRIDE—JAMES MALCOLM, of Como, Que. Born at Knoxford, N.B., on July 19, 1917. Educ.: B.Sc., (Civil), New Brunswick, 1938; R.P.E., Quebec; 1938, instru'man, Fraser Co. Ltd., Edmundston, N.B.; 1939-43, dftsman., C.P.R., Montreal; 1944-46, asst. engr., C.P.R.; 1946 to date, asst. engr. of track, C.P.R. (St.1939 Jr.1945).

References: J. E. Armstrong, R. B. Jones, W. G. Dyer, G. E. Shaw, J. G. Sutherland.

MacCALLUM—PETER MALCOLM, 3310 Troie Ave., Montreal, Que. Born at Glasgow, Scotland, Nov. 4, 1917. Educ.: B.Eng., McGill. 1939; R.P.E., Quebec; 1940-45, Lieut., R.C.N.V.R., base mtce. officer, magnetic mine sweeping, executive officer, naval research establishment, etc. With Bell Telephone Company of Canada as follows: 1939-40, student engr., 1945-46, asst. engr., 1946 to date, engr. in transmission group, Quebec Divn., toll and exchange trans. problems, foreign wire relations, etc. (Jr.1940).

References: C. V. Christie, G. J. Dodd, F. F. Fulton, J. J. H. Miller, A. F. Peers, J. H. Trimingham.

McCAY—JAMES TACKABERRY, of Montreal, Que Born at Moose Jaw, Sask., on Feb. 6, 1921. Educ.: B.A.Sc., (Chem.), British Columbia, 1943; R.P.E., Quebec; 1943-45, jr. eng., Bahrein Petroleum Co. Ltd.; 1945-46, supervisor, McColl Frontenac Oil Refinery, Mtl. 1946 to date, gen. mgr. National Heating Products Ltd., Du-Wright Agencies Ltd. (Jr.1946).

References: W. W. Timmins, B. A. Margo, A. F. Farquharson.

McCOLEMAN—HUGH ALEXANDER, of Montreal, Que. Born at Redcliffe, Alta., March 22, 1914. Educ.: B.Sc., (Elect. Engrg.), Alberta, 1936; 1937, plant drftsman. and asst. plant engr., prod. machine design, mtce., etc., Dominion Glass Co., Redcliff, Alta., 1939, dftng. and instln., supvr. of reinforced concrete swimming pool, Town of Redcliff, Alta.; 1939-40, genl. surveying with irr. project, topography (plane table), etc., Canada Land and Orr. Co. Ltd., Medicine Hat, Alta.; with Aluminum Co. of Canada, as follows: 1940, genl. engrg. dept., reinforced concrete detailing, 1940-43, elect. dftng. power and lighting, 1943-45, remelting dept. engr., Kingston works; at present, elect. engr., elect. conductor dept., design and develop't. of conductors and accessories, Montreal, Que. (St.1936. Jr.1942).

References: D. W. Hayes, M. E. Hornback, W. L. Pugh, S. R. Banks, F. L. Lawton, J. L. Davison.

McCRADY—DONALD CARMAN, of 602 Stewart St., Peterborough, Ont. Born at Montreal, Dec. 17, 1914. Educ.: B.Eng., McGill, 1936; R.P.E., Ontario. With Can. Gen. Elec. Co., as follows: 1936-37, test course, Peterborough; 1937-39, commercial dept. (sales engrg.), Toronto; 1939-42, res. agent, N.W. Quebec District (sales engrg); 1942 to date, senior asst. engr., industrial and central station, engrg. divn., Peterborough. (St.1935. Jr.1942).

References: J. L. McKeever, B. I. Burgess, A. R. Jones, H. R. Sills, G. R. Langley.

McDOUGALL—WILLIAM ALLAN, 1133 Walker Road, Windsor, Ont. Born at Saint John, N.B., July 17th, 1920; Educ.: B.Sc. (C.E.), Univ. of N.B., 1941; R.P.E., Ont.; 1941-43, with Dept. of Transport, instrumentman, civil aviation branch, Sydney Airport and Buchans Airport, also various zoning and location surveys; 1943-44, Lieut., R.C.E.; 1944-46, Lieut., C.I.C. (Transferred to Infantry to get overseas); 1946-47, dftsman., structural squad, and at present, estimator, estimating dept., Canadian Bridge Co., Walkerville, Ont. (St.1941. Jr.1943).

References: E. O. Turner, D. C. Bowlin, A. S. Donald, W. G. Mitchell, W. R. Mitchell, P. E. Adams.

MacGIBBON—JAMES ALEXANDER, of Windsor, Ont. Born at Brownsburg, Que., Nov. 3, 1910. Educ.: B.Eng., (Mech.), McGill, 1937; R.P.E., Ontario; with Canadian Industries Limited, as follows: 1937-39, dftng. & design, 1940-43, asst. project engr., small arms, ammun. plant layout & design, D.I.L., 1943-44, sr. supvr. plant mtce., Westmount Tool Works, D.I.L., 1944 (5 mos.), supt., plant engrg., Montreal works, 1944-46, asst. project engr., engrg. dept., and at present, works engr., production divn., chemical group, Windsor, Ont. (St.1937. Jr.1940).

References: I. R. Tait, H. C. Karn, H. B. Hanna, H. L. Johnston, J. B. Francis.

McGREGOR—DOUGLAS ROBERT, of Peterborough, Ont. Born at Sherbrooke, Que., May 2nd, 1914; Educ.: B.Eng., McGill, 1935; R.P.E., Ont.; 1942-45, Elect. Lieut., R.C.N.V.R.; With Can. Gen. Elec. Co. as follows: 1935-36, test course, 1936-42, and 1945 to date, asst. industrial control engr. (St.1933. Jr.1942).

References: J. C. Allan, W. T. Fanjoy, A. R. Jones, J. L. McKeever, H. R. Sills, F. R. Pope, R. L. Dobbin.

McINTOSH—WILLIAM GARDNER, of Vancouver, B.C. Born at Winnipeg, Man., Aug. 19, 1913. Educ.: B.Sc., (Elect. Engrg.), Manitoba, 1937; 1937-38, dftsman., Trans-Canada Airlines, Winnipeg; 1938-40, prod. clerk & engr., Boeing Aircraft of Canada, Ltd., Vancouver, B.C.; with R.C.A.F. as follows: 1940-, Aero Engr. Officer., 1940-41, Air Force H.Q., Directorate of Aircraft Develop't., 1942-43, Chief Engr. Officer, Cool Harbour, B.C., 1943, (6 mos.), Group Engr. Officer, No. 2 Group H.Q., Victoria, B.C., 1943-44, Chief Engr. Officer, Rofino, B.C., 1944-45, Staff Officer, W.A.C. H.Q., Vancouver, B.C.; 1946 to date, district surplus property representative, War Assets Corporation, Vancouver, B.C. (St.1935. Jr.1941).

References: V. Michie, J. T. Dyment, E. P. Fetherstonhaugh, N. M. Hall, E. R. Love, C. W. Crossland.

MACKAY—WILLIAM BRYDON FRASER, of Minneapolis, Minn. Born at Winnipeg, Man., May 21, 1914. Educ.: Graduate, R.M.C., 1934; B.Sc., (Elect.), Manitoba, 1938; B.Met.Engrg., Minnesota, 1940; M.S., Minnesota, 1947; with R.C.A.F., as follows: 1940-43, Central Navigation School, Rivers, Man., rank of F/O., 1943-44, O.C. Mtce. Wing & Chief Engrg. Officer, Gimli, Man., 1944-45, O.C. Mtce. Wing & Chief Engrg. Officer, promoted to Wing Cmdr., 1945, Debert, N.S.; 1946 to date, Instructor in Dept. of Metallography, lecturer and lab. work to Metall., mech., elect. & aero. students, also member of faculty of graduate school, Univ. of Minnesota, Minn. (St.1936. Jr.1941).

References: E. P. Fetherstonhaugh, A. E. Macdonald, N. M. Hall, W. F. Riddell, G. M. Minard.

MacKENZIE—IAN DONALD, of Montreal. Born at Montreal on Aug. 5, 1917. Educ.: B.Sc., (Geology), Queen's, 1940; R.P.E., Quebec. 1940-to date, field engineer and geologist, Shawinigan Engineering Company. (Jr.1941).

References: J. A. McCrory, R. E. Heartz, C. R. Lindsay, A. L. Patterson, E. V. Leipoldt.

McKEOWN—LEWIS AUSTIN, of Chicago, Ill. Born at Que bec City, Dec. 29, 1916. Educ.: L.Sc., Univ. of Montreal, 194 with Aluminate Chemicals Ltd., Toronto, Ont., as follows: 194 41, asst., service dept.; 1942-45, field service engr.; 1946 to dat i/c mfg. section, tech. dept., National Aluminate Corp., Chicag Ill. (Jr.1944).

References: H. M. Esdaile, G. R. Connor, G. F. Layne, C. Jackson, H. G. Thompson, C. F. Walker.

MacKIMMIE—ROBERT D., 576 Water St., Peterborough, On Born at Montreal, Nov. 21, 1915. Educ.: B.Eng., McGill, 193 R.P.E., Ontario; 1943-46, Radar Officer, R.C.E.M.E.; with Ca Gen. Elec. Co. as follows: 1938-39, test course; 1939-43, as engr., induction motors; 1946 to date, asst. engr., mete (Jr.1941).

References: V. S. Foster, A. R. Jones, A. L. Malby, J. Watts, D. J. Emery, G. C. Tollington.

MacKINNON—WILLIAM DONALD, 105 N. Court St., Po Arthur, Ont. Born at Winnipeg, Man., Apr. 9, 1917. Educ.: B.S (Civil), Manitoba, 1941; instrumentman & junior engr., worl & bldg. divn., R.C.A.F. 2nd Training Command; 1943-44, instru tor of inspection trainees & inspr. on aircraft work, Macdona Bros. Aircraft Ltd., Airport Divn., St. James, Man.; 1944- groundwater survey, mapping, topographic survey, Water R sources Br., Prov. of Man.; at present, engr., dfting & desig C. D. Howe Company Ltd., Port Arthur, Ont. (St.1940. Jr.194

References: W. W. Ramsay, G. H. Herriot, B. B. Hogarth, H. Attwood, D. W. Laird, A. E. Macdonald.

McLACHLIN—HUGH FREDERICK, of Port Nelson, Ont. Bo at Arnprior, Ont., Nov. 8, 1907. Educ.: Graduate, R.M.C., 193 with Canadian Westinghouse Co., Hamilton, as follows: 1930- apprentice course; 1934-40, sales dept.; 1940-45, Royal Canadi Engineers, rank of Captain, subsequently Major; 1945 to dat sales dept., preparation of quotations on electrical apparat Canadian Westinghouse Co., Hamilton, Ont. (St.1931. Jr.1936).

References: H. A. Cooch, J. R. Dunbar, D. W. Callander, S. Glover, E. E. Orlando.

McLAUGHLIN—WILLIAM GORDON, of St. Catharines, On Born at Cumberland, Ont., Sept. 16, 1910. Educ.: B.Sc., (Mech Queen's, 1934; M.M.E., (Hydraulics), Rensselaer Poly. Inst., Tro N.Y., 1936 (accredited E.C.P.D.); R.P.E., Ontario; 1936-38, fie engr., constrn. bleach sulphide plant, E. B. Eddy Co., Hull, Qu 1938-39, field engr. on jobs, Heron Bay, Quebec, Scotstown, et 1939 (4 mos.), field engr., constrn. S.S. piling dock, New Ca lisle, Que., Aiken & McLaughlin, St. Catharines, Ont.; 1939- asst. master mech., newsprint mill, Consolidated Paper Cor Grand'Mere, Que.; 1940-44, engr., estimater on contract Rainb Bridge, Niagara Falls, contract, Algoma Steel Corp., etc., Aik & McLaughlin Ltd.; 1944-45, Engr. Officer, R.C.N.V.R.; 1945 mos.), rly. survey, Dept. of Transport; 1945 to date, engr. Aik & McLaughlin, St. Catharines, Ont. (Jr.1937).

Refereces: D. W. McLachlan, A. N. Ball, C. Stenbol, O. McCulloch, M. H. Jones, J. B. Stirling.

McLEAN—ALEXANDER FRANCIS, of Montreal, Que. Bo at Melbourne, Ont., Nov. 7, 1917. Educ.: B.A.Sc., (Elect.), Toron 1940; R.P.E., Quebec; 1940-41, materials engr., Fraser Bra Engrg. Ltd.; 1941-43, asst. elect. engr., responsible for pla elect. mtce.; 1943-45, elect. engr., supvr. instln. elect. equip etc., Canadian Vickers Ltd., Montreal; at present elect. en or elect. supt., tube & steel divn., Dominion Steel & Co Corporation, Montreal, Que. (St.1940. Jr.1944).

References: W. E. Bown, J. R. Auld, A. D. Ross, J. L. Davisc W. S. Wilson, D. Anderson.

MacLEOD—ERNEST MILTON of La Tuque, Que. Born Cleveland, Nova Scotia, on Dec. 26, 1896. Educ.: B.Sc., (Elect Nova Scotia Technical College, 1926; with Shawinigan Water Power Company as follows: 1926-27, wheelman & operat engineering company; 1928-30, supervising relay installatio Gatineau Power Co.; 1930-32, control & relay wiring; 1932- electrician, J. R. Booth Co.; 1939-44, shift operator, Shawinig Water & Power Co.; 1944 to date, asst. power house supt., Tuque, Que. (Jr.1930).

References: F. H. Sexton, L. B. Stirling, B. C. Hicks, R. Heartz, R. D. Packard, H. J. Racey.

MacLEOD—FREDERICK JAMES GORDON, Kilmar, Que. Bo at Montreal, March 9, 1922. Educ.: B.Eng., (Civil), McGill, 19 R.P.E., Quebec; Summers—1941, checker, Dept. of Transpo Civil Aviation; 1942, instrumentman, C. C. Lindsay, M.E.I. 1943, Temp. 2nd Lieut., R.C.E.; 1944-46, R.C.N.V.R., Sub.-Lie to Lieut. in Constructor Branch—on ventilating fans, pum winches, other naval machinery, air conditioning on na machinery, air conditioning on naval vessels, consultant installn. of air conditioning in a frigate for experimental pu poses, mtce. of said equipment during tropical trials—complet report on above prior to demobilization; At present, asst. to pla engr., mainly i/c surveying for installn. of new kiln, also co crete design & form work, timber truss design, mach. install hydrographic surveys, domestic & plant bldg. design & constr supervision and plant mtce., Canadian Refractories Ltd., Kilm Que. (St.1944. Jr.1946).

References: R. DeL. French, G. J. Dodd, C. C. Lindsay, J. O'Neill, F. M. Wood, I. G. Henderson.

McMATH—ANDREW ALLAN BROWN, of Cornwall, O Born at St. Lambert, Que., Feb. 26, 1911. Educ.: B.Eng., (Mech McGill, 1934; R.P.E., Quebec; 1934-35, dftsman., Sherbroo Machineries Ltd.; 1935-36, demonstrator, mech. engrg., McG Univ.; with Canadian Ingersoll-Rand Co., Ltd., as follow 1936-37, dftsman., air compressors, 1937-40, pulp & paper eng Sherbrooke works; 1940-42, supvr. for special war produc late, 1942-45, supvr. all plant products C.I.L., Dominion Am Divn., Brownsburg, Que.; 1945-46, layout engr., mech. equip Foundation Co. of Canada, Ltd., Montreal; 1946-47, layout eng design, pulp & paper mills, Stadler, Hurter & Co., consul engrs., Montreal; at present, plant equipt. layout, Howard Sm Paper Mills Ltd., Cornwall, Ont. (St.1934. Jr.1938).

References: H. E. Meadd, A. T. Hurter, C. J. Jeffreys, D. MacCallum, R. Bruce.

McMATH—JOHN PROCTOR CLARK, of Verdun, Que. Born Ranfurly, Alberta, on Nov. 3, 1913. Educ.: B.Sc., (Elec.), lberta, 1936; with Northern Electric Co. as follows: 1937-44, sign engr., current engrg. dept.; 1944—to date, engr. elect. b, Wire & Cable Div., Montreal. (St.1936. Jr.1942).

References: W. G. Tyler, N. L. Morgan, H. Miller, N. L. Dann, A Kerr. C. C. Simpson, E. S. P. Braddell.

McKEEKIN—GEORGE REX, of Trail, B.C. Born at Calgary, ta., Dec. 15, 1918. Educ.: B.Sc., (Chem. Engrg.), Alberta, 1941; th Consolidated Mining & Smelting Co. of Canada, as follows: 41-43, shift analyst, 1943-44, plant tester, tech. Librarian & arge prod. and equipt. records, 1944-45, asst. to supt. ammonia vn., Calgary, Alta., 1945; chem. engr., phosphate plant, Trail, C., and at present, asst. to supvr. staff dept., personnel divn., ail, B.C. (Jr.1944).

References: J. V. Rogers, R. W. Diamond, C. E. Marlatt, E. M. iles, S. C. Montgomery.

McPHERSON—JAMES DONALD PERRIN, of Montreal. Born Sioux Lookout, Ont., Aug. 15, 1920. Educ.: B.Sc., (Civil), Alrta, 1943; summer work as follows: 1941, chainman-rodman, N.R.; 1942, head chainman, levelman, (location & design aska Highway) U.S. Public Roads Admin.; 1943, senior technil officer, R.C.N., building constrn. corps; 1944-45, engr. officer machinery, R.C.N. ships; at present, district engr. Fountion Co. of Canada. (St.1942. Jr.1946).

References: R. E. Chadwick, W. Griesbach, E. M. VanKought, S. J. Montgomery, R. M. Hardy.

McRAE—WILLIAM ROBERTSON, of Calgany, Alta. Born at lgary, Oct. 14, 1917. Educ.: B.Sc., (Chem.), Washington State llege, 1943. Accredited E.C.P.D. 1942, petroleum engr., Royalite l Co.; 1943-44, petroleum engr., General Petroleums; 1944-45, el officer, R.C.N.V.R.; 1945-47, managing director of Western ay & Chemical Supply Co. Ltd., Calgary, Alta. (Jr.1945).

References: J. F. Langston, F. K. Beach, C. J. L. Sanderson.

NATTRESS—DAVID IRVING of Toronto, Ont. Born at Woodidge, Ont., April 11, 1897; R.P.E., Ontario. Educ.: B.A.Sc., Torto, 1923. 1923, elect. mtce., Steel Plant Surveying; with E.P.C. as follows: 1924-27, meter & relay engr.; 1927-44, supersing municipal, rural elect. utilities, planning for improvents, and extensions, cost analysis; 1944-47, area enlarged pervision of other engrs. on similar work, Toronto.

References: H. E. Brandon, E. A. Cross, J. L. Lang, R. L. bbin, K. G. Ross.

OATWAY—HAROLD CALLAGHAN, 3 Havelock St., Toronto, t. Born at Stoney Plain, Alta., July 23, 1914. Educ.: B.Eng., cGill, 1939; R.P.E., Ontario. 1940-41, demonstrator, Mech. grg., McGill Univ.; 1941-43, design & development officer, Air rce HQ.; chief engr. officer, No. 12 Training Group, R.C.A.F.; 44-45, stress analyst & designer, Douglas Aircraft Co., Santa onica, Calif.; 1945-46, stress analysis, group leader, Canadair d., Montreal; at present, stress analysis, section leader (strucres), A. V. Roe Canada, Malton, Ont. (St.1937. Jr.1942).

References: H. S. Rees, H. Lamb, C. W. Crossland, J. Gould, A. Robb, R. N. Ferguson.

OLIVER—JAMES, of Cornwall, Ont. Born at Calgary, Alta., ov. 23, 1913. Educ.: B.Sc., (Civil), Alberta, 1937. 1937-38, mine rveyor, Melba Gold Mines Ltd., Bourkes, Ont.; 1938, instru'an., E. G. M. Cape & Co., Montreal; 1939, layout engr., Anglinorcross Ltd.; J. L. E. Price & Co., as follows: 1939-40, constrn. gr., Guncotton plant, Beloeil, Que., 1940-41, constrn. engr., tension R.C.A. Victor plant, constrn. filtration plant, Arvida, ıe.; Canadian Industries Ltd., as follows: Winnipeg, 1941-42, tce. engr., 1942-44, shops engr., 1944-45, asst. res. engr., 1945-46, s. engr. and supt. of mtce. & constrn., i/c demolition; 1946 date, sr. engr., (on constrn. staple fibre plant for Courtaulds anada) Ltd., Cornwall, E. G. M. Cape. & Co. (St.1936. Jr.1941).

References: J. B. Stirling, W. D. Kirk, J. L. E. Price, J. H. lmason, R. M. Hardy, D. G. Anglin.

OSBORN—JOHN FOLLETT, of 554 Reid St., Peterborough, t. Born at Montmartre, Sask., Aug. 21, 1914. Educ.: B.Sc., lect.), Man., 1936; R.P.E., Ontario. 1936, field work, road nstrn. project., Prov. of Man.; with Can. Gen. Elec. Co. as llows: 1937-38, student test course, 1939, asst. test foreman, 1939- date, asst. engr., industrial control engrg. divn. (St.1936. 1943).

References: G. R. Langley, R. L. Dobbin, D. V. Canning, A. Dickieson, B. I. Burgess, J. C. Allan, H. R. Sills, A. R. Jones.

PADLEY—GILBERT, of Kingston, Ont. Born at Kamsack, sk., Feb. 6, 1914. Educ.: B.Sc., (Elect.), Saskatchewan, 1937; th Canadian Westinghouse Co., Ltd., Hamilton, as follows: 37-39, elect. engrg. apprent., 1939-40, sales correspondent; 40-42, asst. elect. engr., Trinidad Leaseholds Ltd., B.W.I.; with luminum Co. of Canada, as follows: 1942-44, shift power engr., rvida, Que., 1944 to date, tech. dept., Kingston, Ont. (Jr.1942).

References: W. S. Black, M. G. Saunders, J. W. Ward.

PAGE—JOHN EDWARD, 998 Jessie Ave., Winnipeg, Man. orn at Winnipeg, June 12, 1923. Educ.: B.Sc., (C.E.), Man., 45; R.P.E., Manitoba; May 1942, dftsman., reinforced concrete sign. Cowin & Co.; 1942 (summer), surveyman & assoc. engr., S. Army Engrs.; May 1943, jr. Instrumentman & lab. asst.; t. 1943, materials section, Manitoba Highways Branch; 1944 ummer), Cadet, 1945 (Apr.-Nov.), Lieut., R.C.E.; 1945-46, asst. materials engr. and acting materials engr., Highways Br., an. Dept. of Public Works; Nov. 1946 to date, tech. asst., town anning, taxation, appraisal work, land dept., Hudson's Bay ompany, Winnipeg, Man. (St.1944. Jr.1945).

References: E. P. Fetherstonhaugh, A. E. Macdonald, G. B. illiams, J. L. Charles, W. E. Hobbs, C. V. Antenbring.

PALMQUIST—DAVID ERNEST, of 549 Allendale St., Windsor, nt. Born at Moose Jaw, Sask., March 28, 1917. Educ.: B.Sc., .E.), Man., 1937; 1943-46, Elect. Lieut., R.C.N.V.R.; with anadian Industries Ltd., as follows: 1937-38, elec. dftsman., 38-39, power house clerk, 1939-42, elec. dftsman., 1942-43, elec. gr. (D.I.L.), 1946 to date, elec. engr., Windsor Works. (St.1937. r.1944).

References: H. C. Karn, D. A. Killam, H. L. Johnston, J. R. uld, J. T. Howley.

PAQUIN—PAUL EDWARD, of 2336 Wilson Ave., Montreal, Que. Born at Montreal, Nov. 16, 1919. Educ.: B.Eng., (Civil), McGill, 1940; R.P.E., Quebec; 1940 (6 mos.), materials distribution at D.I.L. plant, Nobel, Ont., for Fraser Brace Ltd.; 1941, i/c mtce., acid & guncotton plants, D.I.L., Nobel, Ont.; 1942 (3 mos.), i/c layout Vickers boiler shop, Atlas Constrn. Co.; 1942-44, Aluminum Co. of Canada, designing heavy concrete structures; 1944 to date, sales engrg., Canadian Liquid Air, Montreal, Que. (St.1940. Jr.1946).

References: F. G. Kerry, G. H. Griffiths, S. R. Banks, R. E. Jamieson, R. DeL. French, G. J. Dodd.

PARKER—EDMUND NORVAL, of Dorval, Que. Born at Lachine, Que., May 24, 1913. Educ.: B.Eng., (Mech.), McGill, 1937; R.P.E., Quebec; 1937-40, detailer & checker, mech. drawing office, 1940-43, mech. designer, Dominion Bridge Co., Ltd., Lachine, Que.; 1943-45, R.C.N.V.R., Engineer Officer, i/c machinery on H.M.C. Ships, etc., with rank of Lieut. (E); 1945 to date, mech. designer, Dominion Bridge Co., Ltd., Lachine, Que. (St.1937. Jr.1940).

References: R. H. Findlay, R. S. Eadie, M. B. Halpenny, A. E. Pickering, T. Eardley-Wilmot, K. O. Whyte, J. P. Watson, J. Smith.

PARKER—WILLIAM ERNEST BAIN, of 216 Deloraine Ave., Toronto, Ont. Born at Parkersville, Ont., Oct. 6, 1912. Educ.: B.A.Sc., 1935, M.A.Sc., 1936, Toronto; R.P.E., Ontario; 1937-38 (4 mos), dfting. instrument work, Brobst Forestry Co., Toronto; 1937 (3 mos.), sampler and lab. work, Ont., Dept. of Health; 1938-40 (13 mos.), demonstrator in hydraulics, Univ. of Toronto; 1939, instrumentman, dftsman., Township of Scarsboro; 1940-42, jr. engr., 1942 to date, asst. testing engr., H.E.P.C. of Ontario, Toronto, Ont. (Jr.1941).

References: W. P. Dobson, R. B. Young, H. C. Ross, A. D. Hogg, E. R. Graydon, F. Noakes.

PARRISH—VERNON MacLEOD, Winnipeg, Man. Born at Medicine Hat, Alta., Feb. 16, 1915. Educ.: B.A.Sc., (Mech.), Toronto, 1938; 1938-39, cadet engrg. course, and 1939 to date, sales service engr., Bailey Meter Co. Ltd., Winnipeg, Man. (Jr.1943).

References: E. W. R. Butler, C. B. Jackson, T. E. Storey, G. R. Fanset, N. M. Hall, L. M. Hovey.

PATTERSON—THOMAS McMILLAN, 270 Sherwood Drive, Ottawa, Ont Born at Kincardine, Ont., Dec. 29, 1901. Educ.: B.A.Sc., Toronto, 1925; 1925, rodman, H.E.P.C. of Ont.; 1926, rodman, Fraser Brace Engrg. Co.; 1927 to date, hydraulic engr., International Waterways, Dom. Water & Power Bureau, Dept. of Mines and Resources, Ottawa, Ont. (Jr.1926).

References: V. M. Meek, N. Marr, F. G. Goodspeed, M. F. Cochrane, B. W. Waugh.

PAYTON—ROBERT HURLSTONE, of 99 Tecumseh Ave., London, Ont. Born at Quill Lake, Sask., Oct. 6, 1918. Educ.: B.Sc., (Civil), Sask., 1940; 1940-45, R.C.A.F. Navigation Instructor, also some supervising and O.I.C. of navigation test flight—to airtest navigation equipment; 1945-46, designing lab. test equipment for testing and developing aircraft gas turbines and component parts, Turbo Research Ltd., Leaside, Ont.; 1946 to date, outside plant engrg., Bell Telephone Co. of Canada. (St.1940. Jr.1946).

References: J. C. Keppy, C. J. Mackenzie, R. A. Spencer.

PEABODY—GERALD STEAD, of 171 5th Ave., Ville La Salle, Montreal, Que. Born at Fredericton, N.B., Nov. 15, 1920. Educ.: B.Sc., (E.E.), N.B., 1942. With Canadian Westinghouse Co. as follows: 1941 (summer) dftsman., 1942-44, ap'tice engrg. course, 1943-44, installn. engr. (switchgear) at Shipshaw power house, 1944 to date, service engr. and asst. to district engr., Quebec District. (St.1942. Jr.1944).

References: W. A. Fricker, K. W. Fraser, G. H. Finch, E. E. Orlando, A. F. Baird.

PEGLER—WILLIAM ARTHUR, of 195 Elmwood Ave., London, Ont. Born at Calgary, Alta., June 25th, 1917. Educ.: B.Sc., (Elec.), Alta., 1940; R.P.E., Ontario; 1940-41, students test course, 1941, apparatus sales engr., Can. Gen. Elec. Co. Ltd. With Canadian Industries Ltd. as follows: 1941-44, works engr., alkali divn., Shawinigan Falls; 1944-45, asst. res. engr. (D.I.L.), Nobel, Ont.; 1945-46, works engr., salt divn., Neepawa, Man.; 1946, technical repr., plastics divn., Montreal; 1946 to date, general manager, Detroit Stoker Co. of Canada Ltd., London, Ont. (St.1939. Jr.1946).

References: J. W. Stafford, M. H. Wilson, E. C. Adams, G. E. Humphries, A. C. Blue.

PERRY—GEORGE THOMAS, of Quarries P.O., Ont. Born at Toronto, Sept. 27, 1915. Educ.: B.A.Sc., Toronto, 1939; R.P.E., Ontario; 1939-43, asst. to the director, divn. of mech. engrg., and 1943 to date, junior research engr., gasoline & oil lab., National Research Council, Ottawa, Ont. (St.1938. Jr.1941).

References: C. J. Mackenzie, J. H. Parkin, G. B. Ballard, J. J. Green, I. N. Mackay, J. A. Lynch, N. B. Hutcheon.

PETERSON—ALFRED, of Montreal, Que. Born at Montreal, May 25, 1913. Educ.: B.Eng., McGill, 1934; R.P.E., Quebec; 1934-38, Abitibi Power & Paper Co.; 1938, Ste. Anne Paper Co. (subsidiary of Abitibi), instrument, control work, mostly with odd small engrg. problem; 1939-40, jr. asst. engr., supvrn. work in field, design, surveys, etc., Dept. Public Works of Canada; 1940, plant engr., Asbestos Corp., St. Lambert, Que.; 1941-42, R.C.A.F., works & bldgs. division, bldg. air stn., at Kingston, N.S.; 1942-43, plant engr., Mallinckrodt Chemical Works, Montreal; at present, design engr., Distillers Corporation, Ville La Salle, Que. (Jr.1937).

References: W. S. Raynor, W. B. McLean, E. V. Gage, B. R. Perry, A. P. Benoit.

PHILLIPS—ROY ALEXANDER, 230 Aylmer St., Peterborough, Ont. Born at Vancouver, B.C., May 18th, 1918. Educ.: B.A.Sc., Univ of B.C., 1939; R.P.E., Ontario; 1939-40, student test course, and 1940 to date, asst. switchgear engr., Can. Gen. Elec. Co. Ltd., Peterborough, Ont. (St.1940. Jr.1946).

References: G. R. Langley, B. I. Burgess, F. G. A. Tarr, H. J. MacLeod, A. R. Jone, H. R. Sills, F. R. Pope.

PIETTE—GUILLAUME, of Quebec City. Born at Berthierville, on December 4, 1913. Educ.: B.Sc.A., I.C. (Ecole Polytech.) 1939, M.Sc. Univ. of Michigan 1942; R.P.E., Quebec; 1939-46, soil service, Roads Department; 1946 to date, chief engr., J. U. Ste. Marie. (St.1938. Jr.1941).

References: P. Vincent, P. A. Dupuis, J. O. Martineau, A. O. Dufresne, R. Dupuis.

PRATT—JAMES CRAWFORD, of Winnipeg. Born at Winnipeg, on April 5, 1920. Educ.: B.Sc. (Elect.) Manitoba, 1942; summer work as follows: 1939, stores dept. Manitoba Bridge & Iron Works; 1941, dftsmn., Radio Technicians School; 1942-43, Engr. Officer, R.N. Destroyers; 1943-45, i/c engrg. design section, Naval Research Establishment, Halifax; at present, Manitoba Regional Representative, Technical Information Service, National Research Council, Winnipeg, Man. (St.1942. Jr.1944).

References: B. P. Scull, J. W. Sanger, A. F. Peers, D. A. McCuaig, N. M. Hall.

PRESTON—WILLIAM WALFORD, of Edmonton, Alta. Born at Hamilton, Ont., on Oct. 29, 1910. Educ.: B.Sc. (Civil) Queen's, 1935; 1935-43 seasons, mostly summer work as follows: 1935-38, structural dftsmn., Hamilton Bridge Co.; 1938 (Fall) dept. Civil Eng. Univ. of Alberta; 1939, summer, Dept. Biochemistry; (winter) 1939, dept. elect. engr., Univ. of Alta.; (summer) 1940, dftsmn. plant equip. & building alterations North American Cyanide Co., Niagara Falls; 1941, (summer), dftsman., fabricated steel, timber and brick work, Consolidated Mining & Smelting Co., Trail, B.C.; 1941 (fall) asst. in design of detailed brick bldg., Gasoline Testing Laboratory, Univ. of Alta.; 1942, (summer) dftsmn. reinforced concrete power house, H. G. Acres Consult. Engrs., Niagara Falls, Ont.; 1943 (summer) Horton Steel Works, Fort Erie, Ont.; from Sept. 1938 to present, i/c engineering drawing, descriptive geometry, present rank Asst. Professor. Also instructed in survey school till last year in statics, testing of materials laboratory, University of Alberta, Edmonton, Alta. (St.1935. Jr.1938).

References: C. S. Boyd, R. M. Hardy, A. Jackson, A. Love, H. A. Lumsden, I. F. Morrison, R. S. L. Wilson.

REBIN—PAUL MICHAEL, of Port Arthur, Ont. Born at Blaine Lake, Sask., on Nov. 26, 1915. Educ.: B.Sc., (Mech.), Saskatchewan, 1939; R.P.E., Ontario; with Waterous Ltd., Brantford as follows: 1939-41, dftsm., general designing, estimating of pulp and paper mill; 1941-42, general dftg. of dies, jigs, fixtures for production of anti aircraft gun carriage bodies; 1942-43, i/c dftg. design. asst. engr.; 1943-44, engr. i/c estimating preparation of production drawings of steam powered winches for minesweepers; 1944-45, project. engr., Cockshutt Plow Co. Ltd., Brantford, Ont.; 1945-46, designing engr. Vulcan Iron Works Ltd., Winnipeg; 1946 to date, mech. engr. on constrn. of mill enlargement, layout, installn., Thunder Bay Paper Co. Ltd., Port Arthur, Ont. (St.1939. Jr.1946).

References: G. M. Lyon, D. R. Cameron, H. C. D. Briercliffe, G. C. Cariss, I. M. Fraser, C. J. Mackenzie, T. C. Anderson, W. Malloff.

RICE—ROBERT MACNEILL, of Halifax, N.S. Born at Sydney, N.S., on Feb. 22, 1920. Educ.: B.E., (Mech.), Nova Scotia Technical College, 1944; summer work as follows: 1941, foundry apprentice, Dominion Steel & Coal Corp., Sydney, N.S.; 1942, machinist's helper same company; 1943, electrician's helper, H.M.C. Dockyard, Halifax; 1944-46, Engr. officer, R.C.N.; 1946 to date, industrial sales engr., Imperial Oil Ltd., Halifax, N.S. (St.1944. Jr.1946).

References: E. L. Baillie, B. A. Valde, F. H. Sexton, H. A. Ripley, B. N. Cain, W. P. Graham.

RICHARDS—HILARY JOHN BREWERTON, of Lachine, Que. Born at Winnipeg, Man., Jan. 13, 1912. Educ.: B.Sc., (Civil), Manitoba, 1934; 1934-36, (seasonal), Manitoba Highways, Manitoba Telephones and Ford Motor Co., 1936-38, shop inspectr., responsible for all work leaving foundry, etc., Manitoba Bridge & Iron Works; 1938-41, plant engr., Dominion Briquettes & Chemicals Ltd., Bienfait, Sask.; 1941-44, plant engr., Defence Industries Ltd.; 1944-46, plant engr., Chatco Steel Products; and at present sales engr., representing Wm. Kennedy & Sons Ltd., Owen Sound, in Montreal. (Jr.1936).

References: A. E. Macdonald, A. Sandilands, J. A. H. Henderson, H. B. Hanna, R. J. Merritt, J. E. Thom.

RIOUX—JOSEPH HENRI RENE, of Quebec City. Born at Montreal, on July 3, 1915. Educ.: B.A.Sc., (Civil), Ecole Polytechnique, 1938; R.P.E., Quebec; wth Road Department, Province of Quebec as follows: 1938-41, resident engr.; 1941-44, asst. division engr.; 1944 to date, asst. district engineer, Quebec, Que. (St.1936. Jr.1942).

References: E. Gohier, P. Vincent, P. A. Dupuis, M. Royer, R. Dupuis, E. D. Gray-Donald, C. E. Boisvert, R. Desjardins.

ROBINSON—GORDON MILFORD, of Windsor, Ont. Born at Brampton, Ont., on Sept. 30, 1912. Educ.: B.A.Sc., Univ. of Toronto, 1935; R.P.E., of Ontario; 1935 (Dec.), timekeeper & foreman, W. G. Campbell Const. Co.; 1936 (spring), surveying, dftg., Water Commission, town of Brampton; (summer & fall) 1936, foreman, Armstrong Bros. Const. Co.; 1937, bookkeeper & genl. engr., Dufferin Paving & Const. Maritimes Ltd.; 1938, asst. on various surveys; 1939-40, engr. Camp Borden; 1940-42, Jr. engr. Dept. of National Defence, R.C.A.F. works and bldgs., Camp Borden; with Canadian Bridge Co. Ltd., Walkerville, Ont., as follows: 1942-45, detailing; 1945-46, estimating; 1946 to date, designing radio towers. (Jr.1938).

References: P. E. Adams, A. H. MacQuarrie, W. G. Mitchell, J. M. Wyllie, G. G. Henderson, F. J. Ryder, S. E. McGorman.

ROGERS—JOHN HENRY, of Toronto. Born at Ste. Catharines, Ont., on March 23, 1917. Educ.: B.A.Sc., Toronto, 1939; R.P.E., Ontario; 1939-40, asst. to city engr., Ste. Catharines, Ont.; 1940-41, mech. dftsm.; 1941, asst. engr., Defence Industries Ltd.; 1941-42, instru'man & field dftsm., Hydro Electric Power Commission of Ontario; 1943-44, engr. on staff of works & bldg. officer, R.C.A.F. Station Dartmouth, N.S.; 1944-45, asst. mtce. officer, H.M.C.S. Cornwallis; 1945 (4 mos.), Command Mtce. Officer, Halifax, N.S.; 1945, appraiser, explosion damage claims office, Halifax; 1946 to date, designing engr., Hydraulic Dept., Hydro Electric Power Commission of Ont. (Jr.1940).

References: A. L. McPhail, N. Smith, W. B. Crombie, O. E. Johnston, C. R. Young, O. Holden, T. K. Black.

RONSON—JAMES KENNETH, of Windsor, Ont. Born at Walkerville, Ont., Nov. 11, 1913. Educ.: B.A.Sc., (Mech.), Toronto, 1938; R.P.E., Ontario; with Ford Co. of Canada, Ltd., as follows: 1934-37, (summers), student in training, 1938-39, design of fresh air and exhaust systems, etc., 1939-40, design, military truck chassis, 1940-41, field engr., 1941-45, engr. i/c of Universal and Windsor Carrier design, etc., 1945-46, exp. investigation of machine suitable for gas turbine blocking, 1946, material handling survey, 1946 to date, asst. chief inspectr., inspection dept (Jr.1939).

References: A. D. Harris, V. W. MacIsaac, C. G. Walton, G W. Lusby, F. C. Ansley, J. C. Aitkens.

ROSS—HENRY URQUHART, of Toronto. Born at Sault Ste Marie on Oct. 6, 1912. Educ.: B. Eng., 1936, M.Sc., 1938. McGill 1936-37, chemist, Canadian Furnace Ltd., Port Colborne, Ont. 1938-39, metallurgist, Algoma Steel Corp. Ltd., Sault Ste. Marie 1939-41, Shift Boss, same company; 1941-42, foundry supt. Union Screen Plate Co. of Canada Ltd., Lennoxville, Que.; 1942-43 research engr., Frobisher Exploration Co. Ltd., Toronto; 1943-46 engr. officer, Royal Canadian Naval Volunteer Reserve; to date lecturer, Dept. of Metallurgical Engineering, Univ. of Toronto (St.1936. Jr.1939).

References: G. L. Stephens, B. R. Spenser, J. L. Lang, G. W MacLeod, C. R. Young, W. S. Wilson, P. B. Hughes.

ROSS—JOHN MIVILLE, of Montreal. Born at Montreal on Nov. 21, 1915. Educ.: B.A.Sc., (Civil), Ecole Polytechnique, 1944 R.P.E., Quebec; 1944-45, engr. i/c flaps div., Canadian Car & Foundry Co., Lachine, Que., 1945-46, chief engr., Canadian Structural Steel Works Co. Ltd., Montreal. (St.1941. Jr.1946).

References: J. E. Bertrand, E. G. Clossey, S. Rodwin, T. Lafreniere, L. Cartier.

ROSS—THOMAS WILSON, of Three Rivers, Que. Born at Hawkesbury, Ont., on March 2, 1911. Educ.: B.Eng., (Mech.) McGill, 1935; with New Brunswick International Paper Co. as follows: 1936-39, dftsmn., building and paper mill machinery design; 1939-40, engr., layouts and job estimates; 1940-43, i/c of contracts; 1943-45. mill engr., mill mtce. and constrn. supervision, costs war contracts; 1945-47, mill engr., Canadian International Paper Company, Three Rivers. (St.1935. Jr.1940).

References: L. Sterns, G. D. Davidson, H. W. Burri, C. B Champion, A. H. Chisholm, C. F. Walker.

ROWAN—JOHN JAMES, of Montreal. Born at Ottawa, Ont on Nov. 4, 1912. Educ.: B.A.Sc., (Civil), Ecole Polytechnique 1935, B.Sc., M.I.T., (Mech.), 1936; R.P.E., Quebec; with Imperial Oil Ltd., Montreal, as follows: 1936-38, dftg. surveying, layout 1938-40, estimates, project development and supervising constrn. 1940-42, inspectn. of refinery equipt. and mtce.; 1945-47, Refinery chief engr. (St.1935. Jr.1940).

References: F. C. Mechin, G. L. Macpherson, R. L. Dunsmore A. C. Harrop, C. Scrymgeour, C. E. Carson, C. P. Warkentin.

ROWAN—RUSSELL GILLESPIE, of Lachine, Que. Born at Peterborough, on Dec. 20, 1914. Educ.: B.Sc., (Civil), Queen's 1940; R.P.E., Quebec; 1940-42, engrg. asst., Bell Telephone Co of Canada, Eastern Div. Plant Dept., 1942-45, R.C.A.F. Navigator; 1945-46, asst. engr.; 1947 to date, engr., Bell Telephone Company of Canada, i/c outside plant engrg. at Three Rivers. Shawinigan Falls and Grand'Mere. (St.1939. Jr.1942).

References: J. E. Clark, W. J. S. Dormer, J. A. Loy, L. G Buck, R. Rhodes, A. Jackson, J. D. Lee.

RUSSELL—EARL ALBERT, of Deep River, Ont. Born at Fort William, on Sept. 1, 1915. Educ.: B.A.Sc., Toronto, 1938; R.P.E Ontario; 1938-39, jr. engr., Coca Cola Co. of Can., Toronto; with Defence Industries Ltd.; 1939-41, engr. mtce. and constrn. dept Beloeil Works; 1942-43, constrn. engr.; 1943-44, supt. of mtce. an constrn., Winnipeg, Man.; 1944, supt., Nobel, Ont.; 1944-46, ass resident engr.; 1946-47, supt. mtce. and power services. Chal River; 1947 to date, general supt. of services, National Researc Council, Chalk River, Ont. (Jr.1939).

References: A. B. McEwen, H. Jackson, C. R. Young, J. Auk H. S. Milne.

RUSSELL—HAROLD GEORGE, of Awali, Persian Gulf. Bor at Montreal, May 7, 1918. Educ.: B.Eng., (Chem.), McGill, 194 1940, (4 mos.) asst. to supervisor of tool & machine shop Canadian Industries Ltd., Brownsburg, Que.; 1940-43, grou mgr., high explosive div., Canadian Car Munitions Ltd., Che rier, Que.; 1943 to date, refinery process engr., Bahrein Petro leum Co., Awali, Persian Gulf. (St.1940. Jr.1945).

References: C. Craig, L. C. deTonnacour, J. B. Phillips, C N. Kent, R. Lanctot, D. C. MacCallum, R. DeL. French, A. T Hurter.

RUSSELL—LEONARD JAMES, of Fort Erie, Ont. Born a Fort William, April 27, 1912. Educ.: B.A.Sc., Toronto, 1935. 1935-36, level & transit work with Dept. Nor. Div. (Ont.) on Tran Canada Highway; with Horton Steel Works Ltd.; 1936-40, dft estimating & field & shop work; 1940-47, field engr., Fort Eri Ont. (Jr.1938).

References: W. R. Manock, L. C. McMurtry, C. S. Boyd, G. F Otter.

SAFRAN—NATHAN, of Calgary, Alta. Born at Calgary, Apr 26, 1914. Educ.: B.Sc., Arts, 1935, M.Sc., Alberta, 1936. 1936-3 Royalite Oil Company; 1937-44, instructor in science dept., Pro vincial Institute of Technology, Calgary; at present, head o science & mathematics dept. (Jr.1943).

References: A. Higgins, F. N. Rhodes, S. G. Coultis, J. Mac Millan, R. T. Hollies, J. B. deHart.

SANDERS—ROBERT LEWIS, of Montreal. Born at Ottaw March 1, 1916. Educ.: B.Sc., (Mech.), Queen's, 1941. 1940-41, ass comb. engr., C.I.L. Windsor; 1941-45. Lt. Cmdr. (E) R.C.N.; 194 47, mech. engr., Power Corporation of Canada Ltd., estimatin and power plant design. (St.1938. Jr.1946).

References: J. S. H. Wurtele, G. B. Lamer, D. Anderson, C E. Elkington, H. S. Grove, F. J. Hastie.

SANDERS—WILLIAM ALLISON BAXTER, of Calgary, Alta. rn at Calgary, Nov. 11, 1914. Educ.: B.Sc., (Civil), New Brunsck, 1941. 1941-45, aeronautical engr., R.C.A.F.; 1946 to date, structor in aeronautics & science at the Provincial Institute Technology & Art, Calgary. (St.1940. Jr.1944).

References: A. A. Peebles, F. N. Rhodes, E. W. Wood, W. ook. E. O. Turner, J. H. Moore.

SAWLE—ROSS TREGERTHEN, of St. Catharines, Ont. Born Welland, Ont., March 13, 1913. Educ.: B.Sc., Queen's, 1934; A.Sc., Toronto, 1935; R.P.E., Ontario; Member, A.I.E.E.; joined glish Electric Co. of Canada, Ltd., as a jr. engr. in 1935, with grg. dept. since; design of inductor motors and synchronous chines, for past five years handled all synchronous machine sign. (St.1934. Jr.1940).

References: G. Morrison, A. J. Bennett, R. A. Coombe, D. O. Ramsdale, I. S. Patterson, S. Hairsine.

SCHOFIELD—WILLIAM, of St. Catharines, Ont. Born at kenhead, England, Jan. 10, 1911. Educ.: B.Eng., McGill, 1933; P.E., Ontario. 1933-36, mtc. dftsman. Howard Smith Paper lls; 1936-40, design engr., Alliance Paper Mills; 1940-45, aeroutical engr., R.C.A.F.; 1945-to date, plant engr. i/c mtce. and grg., Alliance Paper Mills, Ltd. (St.1931. Jr.1936).

References: H. E. Meadd, D. Ross-Ross, I. J. Macpherson.

SCHUETT—GEORGE HERBERT, of Kingston, Ont. Born at agara Falls, Ont., March 2, 1919. Educ.: B.Sc., (Civil), Queen's, 3; with Anglin-Norcross Ltd., as follows: 1937-43, (summers), il engr. on constrn; 1943-45, Construction Engr. Officer, C.A.F.; 1945-46, asst. chief engr., Anglin-Norcross Ltd., Montal; 1946-47, constrn. supt., L. G. Ogilvie; and at present, esident & genl. mgr., Schuett Construction Limited. Kingston, t. (Jr.1946).

References: A. D. McGinnis, P. N. Gross, C. D. Woolward, M. Hay, S. D. Lash.

SCOTT—H. MELVILLE, of Hamilton, Ont. Born at Port Elgin, t., March 12, 1917. Educ.: B.A.Sc., Toronto, 1939; 1939-42, nt engr., Ayerst, McKenna & Harrison, Montreal; 1942-46, hnologist, Campbell Soup Co., Ltd., New Toronto; at present, e Capo Polishes Limited, Hamilton, Ont. (Jr.1944).

References: H. S. Irwin, R. Graydon, M. J. C. Lazier, R. R. Laughlin, I. S. Widdifield.

SCRIVENER—RICHARD HARDING, of Toronto, Ont. Born Toronto, Ont., Feb. 1, 1913. Educ.: B.A.Sc., Toronto, 1936; P.E., Ontario; Member, A.S.M.E.; with Dominion Bridge mited, as follows: 1936-37, genl. design industrial platework, ., pressure vessels, plate industrial divn., 1937-40, design and imating industrial platework, pressure vessels, mech. equipt.; 0-45, R.C.N., Engr. Officer, Shipbldg. Br., Ottawa, in Naval ckyard on ship repairs, 2nd i/c with rank of Lt. Cdr. (E), at Tribal Destroyers "Iroquois" and "Huron", Engineer ficer; 1946 to date, genl. design and estimating, R. M. rivener, consultg. engr., Toronto, Ont. (Jr.1937).

References: D. E. Perriton, O. W. Ellis, M. L. Sherwood, C. Morrison, W. G. H. Holt, E. A. Allcut.

SENTANCE—RICHARD CLARENCE, of Hamilton, Ont. Born Foam Lake, Sask., June 10, 1919. Educ.: B.Sc., (Mech.), skatchewan, 1940; 1940-45, R.C.E.M.E., Tech. Officer with nk of Captain; 1945 to date, genl. foreman of weave depts., sponsible for prod., personnel, writing process specifications, ., B. Greening Wire Co., Ltd., Hamilton, Ont. (St.1940. 1946-A).

References: C. J. Mackenzie, I. M. Fraser, W. E. Brown, N. B. tcheon, H. G. Thompson.

SHIENFIELD—IRVINE, Toronto, Ont. Born in Russia, Oct. 6, 14. Educ.: B.Sc., (Civil), Saskatchewan, 1941; 1941-42, field n i/c party and design work in reinforced concrete, P.F.R.A. anch, Dept. of Agriculture, Manitoba; 1942-46, Canadian Army th rank of Lieut.; 1946, jr. hydraulic engr., constrn., P.F.R.A. anch, Dept. of Agriculture; at present, jr. engr., hydraulic ction, design staff, Canadian and General Finance Co., Toronto, t. (Jr.1946).

References: R. A. Spencer, I. M. Fraser, E. K. Phillips, G. L. acKenzie, C. J. Mackenzie, G. O. Vogan, H. L. Dowling.

SIBBALD—STANLEY WALTER, of Northampton, Pa. Born at ronto, Ont., Oct. 8, 1913. Educ.: B.A.Sc., Toronto, 1937; 1937-40, emist i/c lab., Algoma Steel Corp. Ltd., Sault Ste. Marie, t.; 1940-42, supvr. shift synthetic amm. plant, Welland Chemal Works; with Dow Chemical Co. of Canada, Ltd., as follows: 42-43, asst. supt., ethyl benzene plant, 1943-44, supt., 1944-46, pt., styrene crackers; at present, chemical engr., J. T. Baker emical Co., Phillipsburg, N.J. (Jr.1938).

References: D. Simmons, G. Hemmerick, B. B. Hillary, E. W. ll, C. P. Warkentin.

SIMARD—LAURENT, of Arvida, Que. Born at Roberval, Que., pt. 18, 1917. Educ.: B.A.Sc., Laval, 1943; R.P.E., Quebec; with uminum Co. of Canada, as follows: 1943-44, asst. supvr., 1944 date, mech. mtce. supvr., Arvida, Que. (Jr.1945).

References: J. F. Braun, J. L. Connolly, W. Fraser, J. T. chols, J. E. Dyck.

SINCLAIR—GEORGE, of Columbus, Ohio. Born at Hamilton, t. on Nov. 5, 1912. Educ.: B.Sc., 1933; M.Sc., 1935; Ph.D., Ohio ate Univ. 1946; 1936-37, instr. Univ. of Alberta; 1937-39, chief gr., Northern Broadcasting Corp.; 1939-41, grad. asst., Ohio ate Univ.; 1941 to date, supervisor, Antenna Laboratory, Ohio ate University, Columbus. (St.1933. Jr.1942).

References: H. J. MacLeod, F. Noakes, J. W. Porteous, I. F. orrison, R. M. Hardy.

SKELTON—ERIC TUDOR, of Montreal, Que. Born at Montreal, e., Dec. 26, 1918. Educ.: B.Sc., (Civil), New Burnswick, 1942; 42-43, i/c constrn. staff houses, heavy concrete foundations, uminum Co. of Canada, (Demerara Bauxite Co., Mackenzie, G.); 1944-46, Canadian Army, Engr. Works Officer i/c mtce., terations & additions to bldgs., Quebec City, with rank of ptain; at present, engr., engaged on street widening project, ty of Westmount, Que. (St.1942. Jr.1944).

References: P. G. Delgado, M. D. Stewart, D. S. Estabrooks, O. Turner, T. H. Henry, G. A. Campbell.

SMILEY—DONALD CHARLES, Capt., R.C.E.M.E., of Ottawa, Ont. Born at Ottawa, Ont., July 29, 1917. Educ.: B.Sc., (Mech.), Queen's, 1940; R.P.E., Ontario; 1940-41, demonstrator, mech. engrg. dept., Queen's; 1941-42, Instructor, R.C.A.F., radio technicians course given by dept. of elect. engrg., Queen's; 1942 to date, Tech. Staff Officer, Directorate of Mech. Engrg., planning Army workshops prod., various Army Tech. Staff Officer duties, Army H.Q., Ottawa, Ont. (St.1938. Jr.1942).

References: D. M. Jemmett, J. W. Bishop, A. O. Monk, G. W. Thompson, I. M. McLaughlin.

SMITH—ARTHUR DALE, of St. Catharines, Ont. Born at Aberfoyle, Ont., May 12, 1916. B.A.Sc., Toronto, 1939; R.P.E., Ontario; with Foster Wheeler Limited, St. Catharines, Ont., as follows: 1939-42, proposal engr., 1942-45, engr., 1945 to date, i/c preparation of all estimates, designs, performances and complete formal proposals for steam generating equipt., genl. engrg., etc. (St.1939. Jr.1943).

References: J. E. Neilson, A. C. Blue, C. L. Mason, W. C. Lorimer, A. L. McPhail, M. H. Jones.

SMITH—ALLAN GARFIELD, of Toronto, Ont. Born at Ste. Agathe des Monts, Que., Jan. 6, 1914. Educ.: B.Eng., (Elect.), McGill, 1937; R.P.E., Ontario; with Northern Electric Co., Ltd., as follows: 1937-41, asst. to supply and ill. mgr., Montreal; 1941 to date, ill. & industrial heating engr., design and planning lighting instlns., incl. necessary power supply, study of industrial prod. problems, etc. (St.1937. Jr. 1942).

References: D. C. Bordon, W. K. Wiley, J. G. McLellan, C. C. Simpson, W. H. Hooper, A. V. Armstrong.

SMITH—EDGAR BERNARD, of Montreal, Que. Born at Caledonia, N.S., Feb. 9, 1913. Educ.: B.Eng., (Elect.), Nova Scotia Tech., 1939; R.P.E., Quebec; 1939, electrician, Nova Scotia Power; with Canadian Comstock Ltd., Montreal, Que., as follows: 1939-40, electrician & job engr.; 1940-41, layout & estimating; 1941-42, layout & job supt.; 1942-43, job supt.; 1943, job engr.; 1943-44, layout, estimating, & job control; 1944-47, control engr. of field work, and at present, control engr. on layout, estimating & instln. of elect. constrn. projects. (St.1939. Jr.1940).

References: A. D. Ross, A. Wilson, A. C. Johnston, J. L. Davison, G. H. Gillett, T. T. Boutilier.

SMITH—ROBERT RUDOLPH, of Woodstock, Ont. Born at Saint John, N.B., April 18, 1921. Educ.: B.Sc., (Civil), 1943; R.P.E., Ontario; dftsman., (2 summers), National Harbours Board; 1943-45, R.C.E.; with rank of Lieutenant; 1945-46, designer and dftsman., H. G. Acres & Co., Niagara Falls, Ont.; 1946 to date, asst. engr., partnership with W. G. Ure, under name Ure and Smith, Engrs. & surveyors, Woodstock, Ont. (St.1942. Jr.1946).

References: W. G. Ure, J. A. Vance, F. T. Julian, W. M. Newby, E. O. Turner, J. H. Moore.

SNYDER—REINHOLD ROY, of Vancouver, B.C. Born at Wolseley, Sask., Jan. 4, 1918. Educ.: B.Sc., (Mech.), Saskatchewan, 1941; R.C.N., as follows: 1941-43, i/c steaming, H.M.C.S. Prince Robert, 1943-44, i/c engrg. personnel, steaming, H.M.C.S. Nabob, 1944-45, Chief Engr. i/c all machinery with rank of Lieut.; 1945-47, layout and design engr., Pacific Mills Ltd., Vancouver, B.C. (St.1942. Jr.1945).

References: I. M. Fraser, N. B. Hutcheon, B. R. Spencer, P. A. Frattinger, C. W. E. Locke.

STANIFORTH—HAROLD FASSETT, of Montreal, Que. Born at Montreal, Que., Dec. 18, 1916. Educ.: B.Eng., (Mech.), McGill, 1939; R.P.E., Quebec; 1939-40, industrial engr., Dominion Wood Heel Corp., Montreal; R.C.A.F., Aero. Engrg. Branch, with rank of Flight Lieut.; 1944-45, president, i/c mfg. automotive trailers, special equipt. for Dept. Munitions & Supply; 1945 to date, sec. treas., i/c lumber mfg. and logging operations, (Kiosk, Ont.), Staniforth Lumber Co., Ltd., Montreal, Que. (St.1940. Jr.1944).

References: W. J. LeClair, E. Brown, C. M. McKergow, C. K. McLeod, P. H. Morgan, G. O. Johnson, T. J. Kennedy.

STANLEY—JAMES P., of Montreal, Que. Born at Westmount, Que., Aug. 15, 1915. Educ.: B.Eng., (Mech.), McGill, 1938; R.P.E., Quebec; 1938-41, engr., Stevenson & Kellogg Ltd.; 1941-46, R.C.A.F., Aero. Engineer Officer; 1946, engr., Stevenson & Kellogg Ltd.; 1946 to date, cost engr., The Ronalds Co., Limited, Montreal, Que. (St.1938. Jr.1942).

References: P. Kellogg, J. E. Dion, C. W. Crossland.

STEPHENSON—ERIC PAUL, of Peterboro, Ont. Born at Hazel Hill, N.S., Jan. 5, 1917. Educ.: B.Eng., (Elect.), Nova Scotia Tech., 1939; R.P.E., Ontario; 1939-40, testman, Canadian General Electric Co., Ltd.; 1940-41, Royal Canadian Artillery, Searchlight and Generating Stns., Detachment Cdr.; 1941-45, R.C.E.M.E., rank of Major; 1945-46, engr., refrigerator mfg., incl. factory layouts and design, Canadian General Electric Co., Ltd., Peterboro, Ont.; Jan. 1947 to date, asst. signal engr., central region, Canadian National Railways, Toronto, Ont. (St.1939. Jr.1944).

References: G. R. Langley, I. F. McRae, LeS. Brodie, R. L. Franklin, H. R. Theakston, D. S. Nicol, H. P. Cadario.

STEVENS—ROBERT LEONARD, of Montreal, Que. Born at Burmis, Alta., Dec. 18, 1912. Educ.: B.Sc., (Elect.), Alberta, 1935; M.Sc., (Elect.), McGill, 1936; 1936-38, engrg. apprent., Canadian Westinghouse Ltd.; 1938-39, engr., Gatineau Power Co., Ltd., Ottawa; with Canadian Industries Limited, Montreal, as follows: 1939-40, engr., engrg. dept., 1940-44, engr., asst. project engr., acting project engr., engrg. dept., 1945 to date, asst. project engr., responsible for design and requisitioning of materials required for constrn. new plants. (St.1935. Jr.1940).

References: I. R. Tait, A. B. McEwan, C. H. Jackson, D. A. Killam, M. S. Macgillivray, H. C. Karn, W. G. Gliddon, R. C. Silver, J. K. Sexton.

STILES—DOUGLAS DUNCAN, of Toronto, Ont. Born at Fredericton, N.B., July 9, 1915. Educ.: B.A.Sc., Toronto, 1939; R.P.E., Ontario; 1939 to date, jr. designing engr., structl., and at present sr. designing structural engr., E. A. Cross, consultg. engr., Toronto, Ont. (Jr.1940).

References: E. A. Cross, E. R. Graydon, C. F. Morrison, I. S. Widdifield, R. F. Legget.

STONE—JOHN GORDON, of Baie Comeau, Que. Born at Moncton, N.B., July 4, 1918. Educ.: B.Sc., (Civil), Queen's, 1941; R.P.E., Ontario; 1941-42, instru'man, surveying, dftng., etc., i/c field party on track realignment; 1942-46, R.C.E.M.E., with rank of Captain; at present, asst. mtce. supt., dftng., design, tech. supvrn., etc., Quebec North Shore Paper Co., Baie Comeau, Que. (St.1940. Jr.1946).

References: W. H. B. Bevan, L. S. McGregor, G. H. Mickleborg, A. Jackson, J. F. McInnis.

SWARTZ—JOSEPH NORMAN, of Cornwall, Ont. Born at Montreal, Que., Aug. 5, 1911. Educ.: B.Eng., (Chem. Engrg.), 1934; Ph.D., 1937; with Howard Smith Paper Mills Ltd., as follows: 1938-46, control supt., 1946 to date asst. to tech. director, Cornwall, Ont. (St.1934. Jr.1939).

References: H. E. Meadd, W. P. Nesbitt, H. DeWolfe, I. J. MacPherson.

STEVENS—ROBERT LEONARD, of Montreal, Que. Born at Born at Hazenmore, Sask., Feb. 11, 1920. Educ.: B.Eng., Saskatchewan, 1941; R.P.E., Quebec; 1941-42, engr. dftsman., Consolidated Paper Corporation; 1942-45, R.C.A.F., Aero. Engr.; with Consolidated Paper Corporation, Laurentide Div., Grand'Mere, Que., as follows: 1945-46, asst. to divn. engr., 1946 to date, mech. supt. (St.1941. Jr.1943).

References: I. M. Fraser, V. Jepsen, E. T. Buchanan, G. S. G. Henson, G. R. Goring.

TANNER—CHARLES JEWELL, of Arvida, Que. Born at Lakefield, Ont., Jan. 16, 1917. Educ.: B.Sc., (Mining), Queen's, 1939; R.P.E., Quebec; 1939-40, mach. man, Wright-Hargreaves; 1940-43, asst. chief engr., Central Patricia Gold Mines; 1943 to date, supvr., hydrate dept., ore plant No. 1, Aluminum Co. of Canada, Arvida, Que. (Jr.1945).

References: F. T. Boutilier, B. E. Bauman, H. R. Fee, J. E. Dyck, G. A. Antenbring.

TAYLOR—DUDLEY ROBERT, of Winnipeg, Man. Born at Montreal, Que., Sept. 21, 1914. Educ.: B.Eng., (Elect.), McGill, 1937; 1937-38, radio engr., Canadian International Paper Co.; 1938, (3 mos.), control operator, Canadian Broadcasting Corp.; with Trans-Canada Airlines, as follows: 1938-40, radio technician, 1940-43, radio engr., 1943 to date, supvr. radio and elect. engrg., responsible for specifications, instln. and modification of aircraft radio, elect. equipt. and instrument equipt. (St.1936. Jr.1942).

References: J. T. Dyment, C. A. Proudfoot, H. E. G. Dupuy, W. R. C. Taylor, T. H. Kirby.

TAYLOR—FREDERICK WILLIAM, of Toronto, Ont. Born at Toronto, Ont., Aug. 23, 1913. Educ.: B.A.Sc., Toronto, 1936; M.Sc., Illinois, 1946; (accredited E.C.P.D.); R.P.E., Ontario; 1936-39, (4 mos.), dftng. and structl. design, E. A. Cross, consultg. engr., Toronto; 1939, (2 mos.), dftng. and structl. design, Defence Industries Ltd., Montreal; 1940, (2 mos.), asst. to bldg. supt., H. E. Thomas, builder, Toronto; 1940, (2 mos.), field engr., Foundation Co. of Canada, Arvida, Que.; 1940, (5 mos.), dftng. and structl. design, Aluminum Co. of Canada; 1940-45, aircraft inspecn., British Air Commission (Canadian and U.S. service); 1945-46, graduate studies at Univ. of Illinois; 1946 to present, chapter engr., National Warm Air Heating & Air Conditioning Assn., Toronto, Ont. (St.1936. Jr.1938).

References: E. A. Allcut, E. A. Cross, W. H. S. Bird, R. H. Self, T. Dembie.

TAYLOR—WILLIAM EBIN, of Sarnia, Ont. Born at Vernon, B.C., Aug. 19, 1913. Educ.: B.Sc., (Elect.), Queen's, 1935; R.P.E., Ontario; 1935-37, International Nickel Co. of Canada, Copper Cliff, Ont.; 1937-40, International Petroleum Co., Peru, S.A.; 1940-41, Allied War Supplies Ltd., Montreal, Que.; 1941-43, Welland Chemical Works, Niagara Falls, Ont.; 1943 to date, engrg. supvisor, engrg. dept., Polymer Corporation, Sarnia, Ont. (Jr.1939).

References: G. R. Henderson, F. F. Walsh, A. E. C. Slater, F. F. Dyer, C. P. Warkentin.

TELFORD—ROBERT BROWN, of York Mills, Ont. Born in Burma, Aug. 10, 1920. Educ.: B.A.Sc., Toronto, 1943; R.P.E., Ontario; 1941, (summer), H.E.P.C. of Ontario; 1942, (summer), municipal engrg., Township of North York; 1943-45, R.C.N., Engr. Officer, position of responsibility held for two yrs., 1½ yrs. spent as Engr. Officer i/c machinery of a Frigate; 1945-46, Township of York; and at present, structl. engr., Margisson & Babcock, Toronto, Ont. (St.1943. Jr.1946).

Refeences: R. F. Legett, C. F. Morrison, H. A. Babcock, J. R Cockborn, R. M. Scrivener, E. W. McBride.

THIBAULT—JOSEPH GEORGE, of Drummondville, Que. Born at Bonne Madone, Sask., on Dec. 27, 1911. Educ.: B.Sc. (Elect.) Manitoba, 1937; R.P.E., Quebec; 1937-39, elect. dftsm., Canadian Industries Ltd.; with Southern Canada Power Company as follows: 1939-41, engineering apprentice, 1941-47, engr. operating dept., i/c protective relays, all engrg. work on operation & mtce of power station, substation, equipt., Drummondville, Que (St.1937. Jr.1941).

References: D. Anderson, J. S. H. Wurtele, F. W. Tanton, F. A. Chisholm, T. J. Boyle, J. Auld.

THOMLINSON—WALTER LEONARD, of Galt, Ont. Born at Edmonton, Alta., July 10, 1915. Educ.: B.Eng., McGill, 1938; 1938-40, asst. to chief engr., mtce., design of new equipt. instlns., B.C. Sugar Refinery Co., Ltd.; 1940-45, R.C.A.F., O.C. Aircraft Inspectn. Detachments; with Babcock-Wilcox & Goldie-McCulloch Ltd., as follows: 1945-46, boiler design engr., 1946 to date, i/c machine design dept., turbines, compressors, pumps, engines, Galt, Ont (St.1937. Jr.1946).

References: F. H. Ballou, F. W. Barnhouse, R. S. L. Wilson, H. E. G. Dupuy, C. M. McKergow.

TOVEE—EDWARD HAROLD, of Hamilton, Ont. Born at Hamilton, Ont., July 5, 1910. Educ.: B.A.Sc., Toronto, 1934; R.P.E., Ontario; with Canadian Westinghouse Co., Ltd., as follows: 1935-36, radio tube production; 1936-38, engrg. apprent. course; 1939-45, materials, engrg. and radio engrg.; 1945, section engr., materials and processes; 1945 to date, section engr. i/c materials and processes section. (Jr.1936).

References: F. W. Paulin, J. R. Dunbar, L. C. Sentance, W. E Brown, N. Metcalfe.

TOY—EDWIN LETENDU, of Toronto, Ont. Born at St. Georg N.B., Oct. 5, 1909. Educ.: B.Sc., (Elect.), New Brunswick, 1931 R.P.E., Ontario; 1931-32, test course, Peterboro & Davenpo works, Canadian General Electric Co., Ltd.; 1933-36, plant elect mtce. of generators and motors, (d.c.), St. George Pulp & Pape Co., Ltd., St. George, N.B.; 1936, (8 mos.), plant elect., responsibl for mtce. generating equipt., motors, pole lines, etc., Conno Bros. Ltd., Black's Harbour, N.B.; with Canadian General Elec tric Co., Ltd., as follows: 1936-38, asst. foreman, test dept., i/ industrial control and switchgear tests, 1938-42, supvr., test dept i/c dist. and power transformer tests, power transformer des gi Davenport works, Toronto, Ont. (St.1932. Jr.1938).

References: C. E. Sisson, D. Norman, W. W. Brumby, P. W Doddridge, H. R. Sills.

TREGGETT—GRAHAM ROSS, of Montreal, Que. Born a Sillery, Que., May 25, 1914. Educ.: B.Eng., (Civil), McGill, 193 R.P.E., Quebec; 1936, jr. engr., Ste. Anne Power Co. (Abitil Power & Paper); 1938, jr. engr., City of Verdun; 1939-41, traf fic studies, Montreal Tramways Co.; 1941-42, garage supt supvrn. repair, mtce. of fleet; 1942-45, R.C.A.F., Flying Office (Pilot); 1945 to date, truck body design, mtce. system, manage ment duties, Coca-Cola Ltd., Montreal, Que. (Jr.1940).

References: R. DeL. French, E. Brown, L. M. Hunter, O. I Brumell, C. A. Duranceau, L. A. Wright.

TREMBLAY—RENE GERALD, of Halifax, N.S. Born at S Esprit, Que., Jan. 13, 1915. Educ.: B.A.Sc., C.E., Ecole Poly 1942; R.P.E., Nova Scotia; 1942-43, (8 mos.), tool engrg., Sor Industries; with Canadian Liquid Air Co., fabrication divn., a follows: 1943-44, training for plant superintendance, 1944-4 asst. plant supt., 1945-47, plant supt. at Halifax branch, super vising fabrication of oxygen, nitrogen, acetylene gases, check ing prod., cost of mtce. of mach.; (period 1946-47, welding in structor, Nova Scotia Tech. Coll.). (St.1941. Jr.1946).

References: G. C. Arthey, G. H. Griffiths, J. E. Simard, I Belanger, R. Lessard.

TRUDEAU—MARC R., of Montreal, Que. Born at Montrea Que., Nov. 7, 1915. Educ.: B.A.Sc., C.E., Ecole Poly., 1940; R.P.E Quebec; 1940-41, res. engr., Lalonde & Valois, C.E.; 1941-4 constrn. engr., Canadian Fairbanks Morse Co., (minesweepers 1942-1945, asst., hydraulics lab., then asst. professor, Ecole Poly technique; at present, designing engr., Lalonde & Valois, civ engrs., Montreal, Que. (St.1939. Jr.1943).

References: R. Boucher, L. Cartier, J. P. Lalonde, M. Geri L. Trudel, R. T. Trudeau.

VAN DAMME—JOSEPH, of Drummondville, Que. Born a Donnacona, Que., June 18, 1919. Educ.: B.Sc., (Mech.), Queen' 1941; M. Aero. Engrg., 1942, Rensselaer Poly. Institute, Tro N.Y. (accredited E.C.P.D.); R.P.E., Ontario; 1942-43, jr. researc engr., National Research Council, Ottawa; R.C.N.V.R., Lieut service in Royal Navy as Air Radio Officer; 1945-46, mec engr., Wm. Kennedy & Sons Ltd., Owen Sound, Ont.; 1946 t date, section engr., Canadian Celanese Ltd., Drummondvill Que. (St.1941. Jr.1946).

References: I. D. Kennedy, J. L. Killoran, J. T. Lakin, M. (Saunders, J. J. Green.

VAN WINCKLE—JACK MULLEN, of Windsor, Ont. Born . Toronto, Ont., April 28, 1915. Educ.: B.A.Sc., Toronto, 194 R.P.E., Ontario; with The Steel Co. of Canada, Ltd., as follow 1940-41, engrg. dept.; 1942-46, i/c engrg. dept.; 1942 to dat plant engr., Canadian Bridge Co. Ltd., Windsor, Ont. (Jr.1943

References: F. J. Ryder, P. E. Adams, G. G. Henderson, A. I MacQuarrie, E. M. Krebser, D. T. Alexander, W. G. Mitchell, ' E. McGorman.

WANLESS—GRAHAM GEORGE, of Sarnia, Ont. Born . Sutherland, Sask., Nov. 29, 1912. Educ.: B.Sc., (Chemistry), Mc Gill, 1934; with Dominion Rubber Co., Ltd., as follows: 1933-3 genl. labs., Montreal, develop't. work on processes, 1938-39, chi clerk, applications of rubber to chemical plant equipt., mec dept., 1939, field engr., field experimental work, 1940, field eng (special applications in mining and paper industries), 1941, ne tech. application of rubber, new products divn., 1941-42, tec work in connection with military goods prod., tank track block cellular rubber; 1942-43, research work arising out of militar requirements and rubber shortage, National Research Counc Ottawa; 1943-46, St. Clair Processing Corp., Ltd.; 1946 to dat assoc. with Polymer Corp. Ltd., from inception as Butyl plai chemist and research chemist i/c control work and researc work on Butyl rubber synthesis and its application to mfg. (inner tubes, Sarnia, Ont. (Jr.1938).

References: R. Ford, C. F. Davison, E. W. Dill, G. R. Hende son, C. P. Sturdee.

WARDROP—WILLIAM LESLIE, of Winnipeg, Man. Born . Whitemouth, Man., Dec. 18, 1915. Educ.: B.Sc., (Elect.), 1939; B.S (Civil), 1947, Manitoba; 1939, instru'man, on survey party, Man toba Gov't. Reclamation; 1941-46, R.C.C.S., Lieut.; 1946, (6 mos. demonstrator, while completing degree in civil engrg., Univ. (Manitoba; at present, engrg. dept., City of Winnipeg, Ma (St.1939. Jr.1941).

References: E. P. Fetherstonhaugh, A. E. Macdonald, G. I Herriot, W. F. Riddell, W. D. Hurst, J. B. Striowski.

WATT—JOHN SIMMONS, of Ottawa, Ont. Born at Dauphi Man., April 1, 1920. Educ.: B.Sc., (Civil), New Brunswick, 194 1944-46, jr. process engr., control work on isomerization plar Bahrein Petroleum Co., Bahrein, Island, Persian Gulf; 1946-4 asst. mtce. engr., genl. engrg. work, Imperial Oil Limited, Mon real; at present, asst. engr., (civil engrg.), National Harbou Board, Ottawa, Ont. (St.1942. Jr.1946).

References: K. M. Cameron, E. G. Cameron, E. O. Turner, G. Goodspeed, L. R. Stratton.

WEBER—PETER ALBERT; of St. Thomas, Ont. Born at Muei ster, Sask., Jan. 28, 1918. B.Sc., (Civil), Saskatchewan, 1940; 194 rodman, Dept. of Transport, airport constrn., Swift Currer Sask.; with Canadian National Railways as follows: 194 instru'man., land survey dept.; 1941-42, instru'man., i/c fie party, land survey dept.; 1942-43, instru'man., engrg. dept.; 194 44, R.C.E.; Canadian National Railways; 1944-46, instru'mar engrg. dept.; 1946 to date, asst. engr. (St.1940. Jr.1942).

References: E. R. Logie, R. A. Spencer, I. M. Fraser, G. V Parkinson.

SLEY—WILLIAM GRANT, of Outremont, Que. Born at real, Que., Jan. 24, 1914. Educ.: B.Eng., (Elect.), McGill, 1937; ., Quebec; 1942-45, Engineer Officer, R.C.A.F.; 1937 to date, exception of War service), sales engr., wire and cable , Northern Electric Co., Ltd., Montreal, Que. (St.1936. Jr.1943).

erences: E. Brown, R. DeL. French, C. V. Christie, G. A. ice, B. C. Nowlan.

STON—NORMAN OWEN, of Hamilton, Ont. Born at Cal- Alta., July 3, 1913. Educ.: B.Sc., (Elect.), Alberta, 1935; ., Ontario; with Canadian Westinghouse Co., Ltd., as fol- 1936-38, engrg. apprent.; 1938-40, design and negotiations, ng divn.; 1940-42, lighting engr.; 1942-43, comptroller's dept., ning ship information systems; 1943-45, Dept. of National nce, Naval Service; 1946 to date, lighting engr., Canadian nghouse Co., Ltd., Hamilton, Ont. (St.1935. Jr.1943).

erences: J. R. Hutton, L. C. Sentance, J. R. Dunbar, A. A. ie, D. W. Callander.

ITE—JOHN ROBERTSON, of Montreal, Que. Born at Park- Sask., Sept. 2, 1916. Educ.: B.Eng., (Mech.), Saskatchewan, R.P.E., Quebec; 1938-39, switchboard operator, elect. mtce., tchewan Power Commission; 1939, instru'man., P.F.R.A., ry, Alta.; 1930-40, dftsman., Consolidated Paper Corp., Three s, Que.; with Canadian Industries Ltd., as follows: 1941, rials engr., (on loan to Fraser Brace Ltd., Transcona, Man.); 42, quantity surveyor; 1942 to date, asst. project engr., Mont- Que. (Jr.1944).

erences: E. K. Phillips, A. L. Cole, W. B. Scoular, C. H. on, A. B. McEwen, I. R. Tait.

ITE—WILLIAM NEWTON, of Saskatoon, Sask. Born at Battleford, Sask., Feb. 20, 1912. Educ.: B.Sc., (Civil), tchewan, 1933; 1934-35, crib foreman, hydro elect. constrn., chuan Rapids, Man.; 1936-40, instru'man, Canadian Malartic Mines, Malartic, Que.; 1944, (summer), asst. to dir., divn. nitation, Dept. of Public Health, Regina, Sask.; 1943-45, in- tor, College of Engrg., Univ. of Saskatchewan; 1945-46, 'man, Canadian National Railways, Saskatoon; 1946, (6 , asst. to dir., Community Planning Br., Dept. of Municipal rs, Regina; 1946 to date, special lecturer, Coll. of Engrg., of Saskatchewan, Saskatoon, Sask. (Jr.1940).

erences: W. H. Ball, C. R. Forsberg, A. Michalenko, I. M. r, E. K. Phillips, P. C. Perry, W. E. Lovell.

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erences: C. C. Simpson, E. S. P. Braddell, D. C. Bordon, E. effrey, J. G. McLellan.

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CONTENTS

COVER PICTURE

The University of Toronto, like most Canadian universities, possesses some examples of fine architecture. The cover picture shows Hart House, centre of varsity theatricals, and the Peace Tower.

ELEMENTARY SHEAR FLOW ANALYSIS

T. R. LOUDON, M.E.I.C.
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A paper specially prepared for publication in *The Engineering Journal*.

The author presents a summary of basic methods for determining shear flow in stringer skin combinations commonly found in aircraft construction. Shear flows due to bending, torsion, both in open and closed sections, as well as in multicell structures and tapered sections are discussed. Problems are worked out as illustrations, and a bibliography added for further reference.

Many discussions on shear flow have appeared from time to time in technical journals and text books; but it has always seemed to the writer that a very simple subject has been allowed to become confused and complicated due to lack of elementary explanations. In an effort to overcome this, it is proposed in the following article to present a résumé of basic methods which can be extended and used for determining shear flow with reasonable accuracy in stringer skin combinations commonly found in modern aircraft construction.

In many problems where the structure is made up largely of thin sheet, the determination of unit shear stress is often most conveniently arrived at by first solving for the shear flow. Fig. 1a represents a portion of thin sheet subjected to shear. When the dimension t is small, as in the case of aircraft stressed skin, it can be assumed that the shear stress and the shear flow are uniformly distributed across the thickness t.

Let dF = total shear on the area dA, Fig. 1a. The shear flow or *shear per unit length* is $q=\frac{dF}{ds}\cdot$ From this it follows that the total shear F, on any length of this cross section, is given by using the proper limits in:

$$F=\int q.ds \quad - - - - - - - - - - - - - - \quad 1a$$

The unit shear at any point is then given by; $f_s=\frac{q}{t}$.

Shear Flow Due to Bending

Fig. 1b represents a cantilever of rectangular cross-section subjected to bending by a load V. Consider the forces acting on a small rectangular element indicated by the shaded portion between sections 1 and 2 taken perpendicular to the neutral axis (N.A.). An enlargement of this element is shown in Fig. 1c, together with the forces acting on it.

Assuming the usual linear variation of flexural unit stress from the N.A. to the extreme fibre, the unit normal stress p at any distance y from the N.A. is given by; $p=y.\frac{f_b}{h}=y.\frac{M}{I}$, where M and I are the bending moment and moment of inertia respectively at the cross section being considered.

The resultant of the normal flexural stresses on section a-b Fig. 1b is;

$$C_1=\sum_a^b p.dA=\sum_a^b\frac{M_1}{I}.y.dA=\frac{M_1}{I}\sum_a^b y.dA \quad - - - \quad (1.)$$

In the same way, for section d-c the resultant of the flexural stresses is;

$$C_2=\frac{M_2}{I}\sum_d^c y.dA=\frac{M_2}{I}\sum_a y.dA \quad - - - - - - - \quad (2.)$$

It follows that, since the bending moment at section 1 is greater than at section 2, $C_1>C_2$. A consideration of the normal flexural stresses on sections 1 and 2 acting above and below the shaded element in Fig. 1b will show that these induce total shears H_a and H_b, acting as shown in Fig. 1c.

There must also be total transverse shears S_1 and S_2 acting as indicated in Fig. 1c.

For equilibrium of the forces acting on the element Fig. 1c;

$$\sum X=C_1-C_2+H_b-H_a=0.$$

Substituting in this the values from (1) and (2) for C_1 and C_2, we get;

$$\frac{M_1-M_2}{I}\sum_a^b y.dA+H_b-H_a=0 \quad - - - - - - - \quad (2a.)$$

Then, if q_a and q_b are the shear flows on the sides (a-d) and (b-c) whose lengths are dx; (see equation 1a which shows that total shear = shear flow × distance).

$H_a=q_a.dx$ and $H_b=q_b.dx$.

Putting these values in 2a, we get;

$$\frac{M_1-M_2}{I}\sum_a^b y.dA+q_b.dx-q_a.dx=0.$$

But $M_1-M_2=dM=V.dx$ which when substituted above gives;

$$\frac{V.dx}{I}\sum_a^b y.dA+q_b.dx-q_a.dx=0.$$

$$q_b=q_a-\frac{V}{I}\sum_a^b y.dA \quad - - - - - - - - \quad (3.)$$

Equation 3 is the basic result from which it is possible to determine the shear flow on a section at any point b, provided the shear flow at some point a is known. The sense in which the shear flow acts, however, is sometimes difficult to visualize, so that certain rules for using equation 3 must be laid down.

Rules for the use of Equation 3

External forces acting upward in the Y axis direction are positive. X and Y co-ordinates are positive to the right and upward respectively from the origin as usual.

If the summation $\sum y.dA$ is made clockwise, equation 3 is written;

$$q_b=q_a+\frac{V}{I}\sum y.dA$$

and a positive answer means that the shear flow q_b is

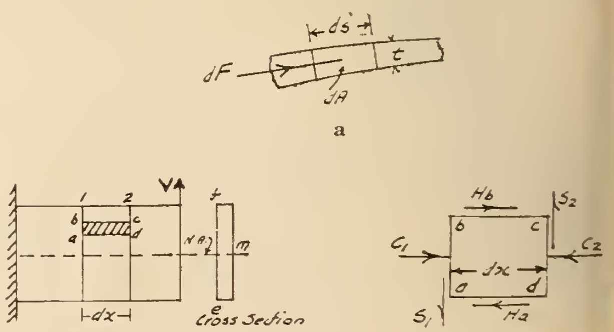


Fig. 1.

clockwise. If the summation is made anti-clockwise, equation 3 is written;

$$q_b = q_a - \frac{V}{I}\sum y.dA$$

and a positive answer still means that the shear flow q_b is clockwise.

Shear Flow Continuity

The principle of shear flow continuity can most easily be seen by considering a section such as shown in Fig. 2a, with a load V causing total compression C_3 above the N.A. and total tension T_1 below the N.A. Fig. 2b is an enlarged view of the shaded portion of length dx in Fig. 2a which will be referred to as a "joint element".

The resultant compression C_1 on the flange to the right of the joint element, due to the bending moment at a being greater than at b, will give unit shear stress S_1 on a-b and an equal stress S_1 on a-d. In the same way, resultant compression C_2 on the flange to left of the joint element will give rise to unit shear stresses S_2.

There will also be acting on the joint element the resultant compression forces C_4 and C_5 with $C_4 > C_5$ so that in general there will be a resultant compression acting on this joint element in the direction and sense of C_4. The shear stresses S_3 as shown are due to the total compression on the upper flange. S_1, S_2 and S_3 are of course average values on the length dx.

Applying the equations of equilibrium, we get;

$$\sum X = S_2t_2.dx + (C_4 - C_5) + S_1t_1.dx - S_3t_3.dx = 0.$$

But $(C_4 - C_5)$ can be shown to be $= \frac{V}{I}.dx\sum y.dA$ where $\sum y.dA$ is the first moment of area of the joint element about the N.A. (See derivation of equation 3 for explanation of this.) Also S_1t_1, S_2t_2 and S_3t_3 are the shear flows q_1, q_2 and q_3 at a, d and c respectively as shown in Fig. 2c. So that we may write;

$$q_2.dx + \frac{V.dx}{I}\sum y.dA + q_1.dx - q_3.dx = 0.$$

$$q_2 + \frac{V}{I}\sum y.dA + q_1 = q_3 \quad - - - - - - - - \quad (4.)$$

(It should be kept in mind that if we determine shear flow values in one direction, these are equal to the values in perpendicular directions.)

The quantity $\frac{V}{I}\sum y.dA$ causes increase of shear flow due to bending resistance, since the resultant of C_4 and C_5 acts toward the section. So that $(q_2 + \frac{V}{I}\sum y.dA + q_1)$ is shear flow into the joint element and q_3 is shear flow out, as shown in Fig. 2c. We see therefore from equation 4 that:

Shear flow into a joint element = shear flow out of the joint element - - - - - - - - - - - - (5.)

Equation 5 is a relation which must always be satisfied, and is extremely useful in helping to determine unknown quantities.

It is important to note that in equations 3, 4 and 5, the quantity I is the moment of inertia of only the *area resisting bending*. It will be seen in many of the following problems that some of the cross section area is assumed as not resisting bending, and therefore should not be used in calculating the moment of inertia.

Shear Flow Due to Torsion

Let Fig. 3 represent a right cross section of a thin cylinder, subjected to an external torsional couple, T. It is assumed that there are no external forces acting on the ends of the cylinder parallel to the longitudinal axis. It is also assumed that on any right cross section of a thin cylinder subjected to pure torsion the shear flow is constant. The validity of this statement has been fairly well established for circular cross sections, and the results obtained by extending the analysis to cross sections similar to those used in aircraft design seem to be quite satisfactory.

The external torsional couple T, acting on the cylinder Fig. 3 will be resisted at any right cross section by the shear on that section. Let the unit shear on dA' in Fig. 3 $= f_s$. Then the total shear dF on $dA' = f_s.dA' = f_s.t.ds$, where t is the thickness of the sheet at the point being considered. Take moments of external and internal forces about any point O. Then for equilibrium; $\sum M = T - \sum(f_s.t.ds)h = 0$. But $h.ds = 2dA$, and $f_s.t = q$ and since the shear flow q is constant around the section;

$$q = \frac{T}{2A} \quad - - - - - - - - - - - - - - - \quad (6.)$$

where A is the area enclosed by the median line of the section in Fig. 3.

If the cross section of the cylinder has a varying thickness, the shear flow q is still constant, but the unit shear stress $f_s = \frac{q}{t}$ will be a variable quantity depending upon the thickness t.

If the resisting moment about any point O of shear between any two points B and C Fig. 3 is required, it is evident that this will be given by:

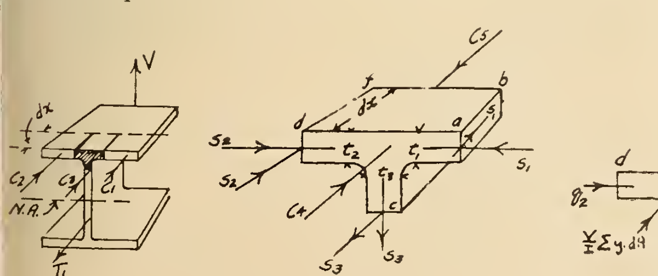
$$M = \int_B^C h.dF = \int_B^C h.q.ds = 2q\int_B^C dA = 2qA' \quad - \quad (6a.)$$

where A' in this case is the area OBC.

If the cylinder is subdivided into two or more cells with enclosed areas A_1, A_2, etc., and if q_1, q_2, etc., are the constant torsional shear flows in the cells, it can be shown that the torsional couple $T = 2A_1q_1 + 2A_2q_2 +$ - - (6b.)

Resultant Total Shear in Curved Sheet Between Two Points

AB in Fig. 4 represents a portion of curved sheet subjected to shear. Let q be the constant shear flow on the section, giving a total shear on the shaded element of $q.ds$ acting tangentially to the median line of the section as indicated. Take the axes of X and Y as



a b c

Fig. 2.

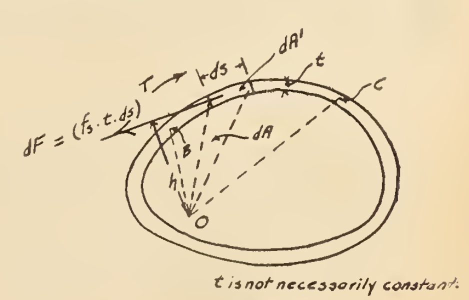


Fig. 3.

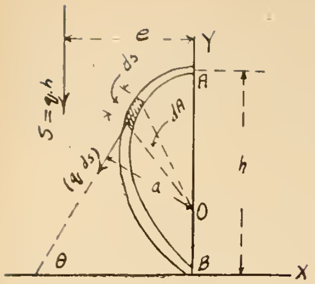


Fig. 4.

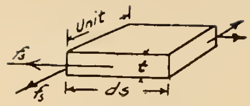


Fig. 5.

shown. The X and Y resolved parts of the shear $(q.ds)$ are respectively: $(q.ds\cos\theta) = q.dx$ and $(q.ds\sin\theta) = q.dy$.

The resultant shear in the X direction, $\int_o^o q.dx = 0$.

The resultant shear in the Y direction, $\int_o^h q.dy = q\int_o^h dy = q.h.$ and since there is no X resultant, this represents the total resultant shear on the section.

So that $S = q.h.$ - - - - - - - - - - - (7)

Therefore, for constant shear flow, the resultant total shear between two points on a thin section = (the shear flow) × (distance between the points).

The location of this resultant shear can be found by assuming its position at a distance e from the Y axis, as shown in Fig. 4. Take moments about any point O on AB;

$$\sum(q.ds)a = (q.h)e$$

$$e = \frac{\sum a.ds}{h} = \frac{\sum 2.dA}{h}$$

$$e = \frac{2A}{h} \quad \text{- - - - - - - - - - - -} \quad (8)$$

where A is the total area enclosed by the median line of the section and the line AB.

Torsional Deformation of Thin Cylinders

Let Fig. 5 represent a unit length small element of the section of thin cylinder Fig. 3. The unit shear on this element due to the torsional couple T is f_s as indicated. The strain energy of the element being considered is therefore;

$$dU = \frac{f_s^2 \times Vol.}{2G} = \frac{f_s^2(t.ds.1)}{2G} = \frac{f_s^2.t.ds}{2G}$$

Total strain energy of the cross section in Fig. 3 *for unit length of cylinder is;*

$$U = \int_o^s \frac{f_s^2.t.ds}{2G} = \int_o^s \frac{q^2.ds,}{2G.t},$$ where s is the perimeter of the section median line.

In most cases G, the modulus of rigidity, is a constant, due to the material being the same throughout the section, so that:

$$U = \frac{1}{2G}\int_o^s \frac{q^2.ds}{t} \quad \text{- - - - - - - - - -} \quad (9)$$

Let θ be the torsional deformation of unit cylinder length produced by the external couple T. Then the work done by this gradually applied couple $= \frac{T.\theta}{2}$.

This must be equal to the strain energy of equation (9), so that;

$$\frac{T.\theta}{2} = \frac{1}{2G}\int_o^s \frac{q^2.ds}{t}.$$

Substituting from (6) the value of $T = 2A.q$, we get;

$$\theta = \frac{1}{2AG}\int_o^s \frac{q.ds}{t} \quad \text{- - - - - - - - - - -} \quad (10)$$

Shear Centre

The shear centre is the point through which an external load must act in order to avoid producing torsional deformation of the section concerned. If the load acts through the shear centre, there will be no resultant torsional deformation, i.e. $\theta = 0$; and since A and G are constant for a given cell, (10) becomes for this case;

$$\int_o^s \frac{q.ds}{t} = 0 \quad \text{- - - - - - - - - - - - - -} \quad (11)$$

Problems Illustrating Methods

The following problems are worked out to illustrate the methods used in applying the equations deduced in the preceding discussion. They are not necessarily exact examples taken from practice, as these are often tedious to work out because of the dimensions involved. The problems have been chosen so that the application of basic theory can be explained in the least time.

Shear Flow in an Open Section

Problem 1.

Let Fig. 6a represent a cantilever channel cross section of uniform thickness $t = \frac{1}{10}$ in. subjected to a total load $V = 205$ lb. giving compression in the upper side. I about the N.A. = 2.05, so that $\frac{V}{I} = 100$. It is required to determine the shear flow on the section and the location of the shear centre, assuming the load V as *acting at the shear centre*. The shear flow will then be due entirely to bending.

The shear flow at a must be zero, since it is at a free surface. Integrating with equation 3 in the anti-clockwise or negative sense from a to b, the shear flow at b will be given by;

$q_b = q_a - \frac{V}{I}\sum y.dA = 0 - 100 \sum y.dA$ (See rules for use of equation 3.)

In this case, $y = 1.95$ in. is a constant, being the distance from each dA centroid to the N.A. so that $\sum y.dA = 1.95\ (2 \times .1)$

and $q_b = 0 - 100\ (1.95 \times 2 \times .1) = -39$ lb. per in. The negative sign means that the shear flow is negative or anti-clockwise.

At b Fig. 6a we encounter a joint element to which we must apply equation (5). There is a shear flow in from the flange of 39 lb. per in., and another shear flow

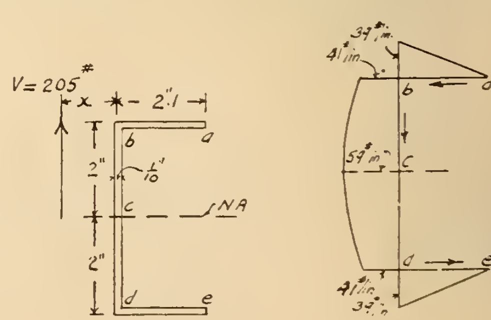


Fig. 6.

in due to compression on the element area of (.1×.1) sq. ins. The shear flow out is determined from;

$q_{b1} = -39 - 100\ (1.95\times.1\times.1) = -41$ lb./in. approximately.

$q_c = -41 - 100\ (1.9\times.5\times1.9\times.1) = -59$ lb./in.

This last result can be obtained by integration as follows:

$$q_c = -41 - 100\int_0^{1.9} y.dA = -41 - 100\int_0^{1.9} .1y.dy$$

$$= -41 - 10\int_0^{1.9} y.dy = -41 - 10\left[\frac{y^2}{2}\right]_0^{1.9} = -59 \text{ lb. per in.}$$

From this it can be seen that the variation of shear flow in the web is parabolic.

$q_{d1} = -59 - 100\ (-\ 1.9\times.5\times1.9\times.1) = -41$ lb. per in.

$q_d\ = -41 - 100\ (-1.95\times.1\times\ .1) = -39$ lb. per in.

$q\ \ = -39 - 100\ (-1.95\times\ 2\times.1) = 0.$

A very close approximation to these results could have been obtained by carrying out the process of equation 3 to the median lines of the flanges and web and neglecting the effect of the joint element bending stresses. This would be quite suitable for practical work. Plotting these results, we get the shear flow diagram shown in Fig. 6b. The shear flow values as determined above are all negative, therefore, the flow is counterclockwise as indicated.

It is now possible to locate the shear centre, since the shear flow shown in Fig. 6b has been determined on the assumption that there is no torsion, i.e. that the external load V acts through the shear centre. It follows that about any point the moment of the shearing forces which give these shear flows on the section must be equal and opposite to that of the external load acting at the shear centre at a distance x from the web median line.

The total shear on the upper flange will be the average shear flow multiplied by the length of the flange. (See equation 1a). Take moments about any convenient point, say d at the junction of the web and lower flange median lines.

$$\sum M = 205x - 39\times.5\times2\times1.95 = 0.$$

$$x = .37 \text{ in.}$$

(The moments of the lower flange and web shears are zero).

This result shows that the load on a channel section should be placed to the rear of the web by some structural method if torsion is to be avoided. The usual placing of the load directly over the channel will cause torsion unless otherwise balanced.

Shear Flow in Closed Sections

If the external load does not act through the shear centre of a beam section, there will be both bending and torsion produced. This will result in a combination of bending shear flow varying in accordance with equation 3 and constant torsion shear flow given by either equation 6 or 6b.

The theory underlying the solution of these problems can be easily understood if the given external load P (Fig. 7a) is replaced by an equivalent load P_1 acting at the shear centre of the section and a couple T_1, the moment arm of which is the distance from the given load P to the shear centre. See Fig. 7a, $P = P_1 = P_2$. The couple T_1 is formed by the forces P and P_2. The equivalent load P_1 acting at the shear centre will produce bending shear flow only, the values of which are found by first assuming a shear flow at a convenient point on the section and then calculating the remaining shear flow by using equation 3.

The resultant total shear $P_3 = P_1$ from this assumed bending shear flow will not in general be colinear with and balance the equivalent load P_1 acting at the shear centre, as indicated in Fig. 7b. Consequently, P_3 acting with P_1 will form a couple T_2 which must be balanced by a constant shear flow to bring P_3 into line with P_1. Adding this constant shear flow to the assumed bending shear flow will give the correct bending shear flow.

To the above final bending shear flow must be added another constant shear flow due to the torsional couple T_1 formed by P and P_2. These couples T_1 and T_2 can be combined and balanced by one constant shear flow, which if added to the assumed bending shear flow will give the final correct flow for the given load. The following problems illustrate this procedure.

Problem 2.

Fig. 7a represents a single cell of constant cross section, in which it is assumed that the stringers and effective widths of skin take all the bending giving *constant shear flow* between the stringers. The areas of the stringers and the effective widths of skin are all .05 sq. in., concentrated at their respective centroids, a, b, c, etc.

It is very important to keep in mind, as mentioned before, that in determining the moment of inertia for the relation $\frac{V}{I}$, only the areas resisting bending are used. Also, the term $\sum y.dA$ is a first moment of area about the neutral axis of only these areas which take bending.

In this case, $I = .05\times3\times2\times3^2 = 2.7$ in.^{4}.

$$\text{and } \frac{V}{I} = \frac{270}{2.7} = 100.$$

Assume a shear flow value in the skin between any two stringers, say zero between stringers a and b (any value of shear flow can be assumed). This will be written $q_{ab} = 0$. Integrating in the positive sense we write;

$q_{bc} = q_{ab} + \frac{V}{I}\sum y.dA = 0 + 100\ (3\times.05) = 15$ lb./in.

$q_{cd} = q_{bc} + 100\sum y.dA = 15 + 100\ (3\times.05) = 30$ lb./in.

$q_{de} = 30 + 100\ (-3\times.05) = 15$ lb./in.

$q_{ef} = 15 + 100\ (-3\times.05) = 0.$

$q_{fa} = 0 + 100\ (-3\times.05) = -15$ lb./in.

$q_{ab} = -15 + 100\ (3\times.05) = 0$ which checks.

These shear flows are indicated on Fig. 7b.

Taking moments about a convenient point say c in the web c-d Fig. 7b and introducing a constant shear

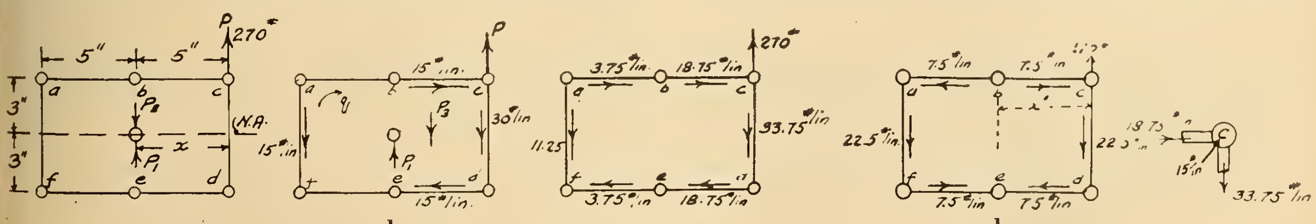


Fig. 7.

flow q assumed positive to balance the torsional couples, we get:

$$\sum M = (-15\times 6\times 10)+(15\times 5\times 6)+(30\times 6\times 0)+(15\times 5\times 0)+270\times 0+2\times 60q=0.$$

$$q=3.75 \text{ lb. per in.}$$

(In the above, the moment of constant torsion shear flow q about any point is given by equation 6 as $T=2A.q$). Adding this positive shear flow to Fig. 7b gives the final shear flow shown in Fig. 7c.

In these types of problems, it is always well to check the flow in and out at joint elements. If the flow in does not equal the flow out, there is a mistake in the calculations.

Fig. 7e shows the conditions at joint element c. It must be kept in mind that the quantity $\frac{V}{I}\sum y.dA$ represents the introduction of shear flow due to bending taken by the compression stringer. It follows that at joint element c there is a flow into the system due to stringer bending stress of 100 $(3\times.05)=15$ lb. per in. This makes the total shear flow in $=18.75+15=33.75$ lb. per in., which is the value of shear flow out as indicated in Fig. 7e.

By using the same method at joint element d, we see that, due to tension bending in the stringer, there is a shear flow out of 100 $(3\times.05)=15$ lb. per in. This is flow out as the stringer is on the tension side. Total flow out is $(15+18.75)=33.75$ lb. per in. which is equal to the flow in. Checking the equilibrium of forces shown in Fig. 7c in the X and Y directions, obviously

$$\sum X=0 \text{ and } \sum Y=270-(11.25\times 6)-(33.75\times 6)=0.$$

The unit shear can be found at any point by dividing the shear flow by the skin thickness. If the shear centre is required for this section, the procedure is as follows; consider the cell as acted upon only by the load P_1 at the shear centre. The resultant shear P_3 from the assumed bending shear flow in Fig. 7b, will not in general be colinear with the load P_1 at the shear centre. This forms a couple which if balanced by a constant shear flow q will bring P_3 into line with P_1.

Now since we are only considering a load acting at the shear centre, there will be no torsional deformation (twist) to the cell, so that we can apply equation 11. Adding a constant shear flow q to that of Fig. 7b, we get from $\int q.ds=0$, since t is constant in this case;

$$15\times 5+30\times 6+15\times 5-15\times 6+32q=0.$$

$$q=-7.5 \text{ lb. per in.}$$

Adding this flow to that of Fig. 7b gives the true bending shear flow shown on Fig. 7d.

This shear flow will balance an external load $P_1=$ 270 lb. acting at the shear centre which is assumed as x in. from c-d Fig. 7a. Take moments about d Fig. 7d in order to locate the shear centre:

$$\sum M=7.5\times 5\times 6-7.5\times 5\times 6-22.5\times 6\times 10+270x=0.$$

$$x=5 \text{ in.}$$

(Shears in c-d, d-e and e-f have zero moments.)

Problem 3 (Multi Cell Structure).

This problem is worked out with a symmetrical section for simplicity of calculation, but the methods outlined can be applied to any sections such as found in aircraft work. The X and Y axes used should be principal axes, otherwise the calculations become involved. The given loads are then resolved into the directions of these axes and applied to the structure.

Let Fig. 8a represent a two-cell constant section cantilever structure in which the stringer skin combinations take all the bending, the load $V=900$ lb. causing compression in the upper stringers. The stringers and effective widths of skin are indicated at a, b, c, etc., the given dimensions being the distances between the centroids of these areas. The stringer skin areas in sq. ins. are indicated beside each circle. For simplicity, the skin is taken of the same thickness $t=.035$ in. throughout.

$$I_x=9\times 2\times 5^2=450$$

$$\frac{V}{I}=\frac{900}{450}=2.$$

Assume zero shear flow in the web c-m. Then at joint element c on the compression side, the shear flow in due to bending will be $\frac{V}{I}\sum ydA=2(5\times 2)=20$ lb. per in. The combined shear flow out into c-b and c-d must equal this 20 lb. per in. since there is no flow in from c-m. Half the flow out will be assumed as going to each side, i.e. 10 lb. per in. in both c-b and c-d, as shown in Fig. 8b. (Any distribution of flow out in c-b and c-d can be assumed as long as the sum equals the flow in which is 20 lb. per in. in this case.)

Using these assumed values of shear flow which satisfy the joint element conditions, integrate around each cell using equation 3. For cell 1, integrating in the negative sense since the shear flow out into c-b is counterclockwise;

$$q_{ba}=q_{cb}-\frac{V}{I}\sum y.dA=-10-2(5\times 1)=-20 \text{ lb. per in.}$$

$$q_{ap}=-20-2(5\times 2)=-40 \text{ lb. per in.}$$

$$q_{pn}=-40-2(-5\times 2)=-20 \text{ lb. per in.}$$

$$q_{nm}=-20-2(-5\times 1)=-10 \text{ lb. per in.}$$

For cell 2, integrating in positive sense in keeping with the assumed shear flow out in c-d;

$$q_{cd}=10 \text{ lb. per in.}$$

$$q_{de}=10+2(5\times 1)=20 \text{ lb. per in.}$$

$$q_{ef}=20+2(5\times 1)=30 \text{ lb. per in.}$$

$$q_{fg}=30+2(5\times 2)=50 \text{ lb. per in.}$$

$$q_{gh}=50+2(-5\times 2)=30 \text{ lb. per in.}$$

$$q_{hk}=30+2(-5\times 1)=20 \text{ lb. per in.}$$

$$q_{km}=20+2(-5\times 1)=10 \text{ lb. per in.}$$

These shear flows are indicated on Fig. 8b.

Now since the two cells are continuous, the twist of each cell is assumed to be the same. In order to bring this about, positive constant shear flows q_1 and q_2 due to torsional couples, as explained in the last problem, will be added in cells (1) and (2) respectively. Then the

Problem 2a.

If the entire section is considered as resisting bending, then the shear flow will vary in the section from point to point in accordance with equations 3 as applied in problem 1. The fundamental method of solution is the same as that used in problem 2.

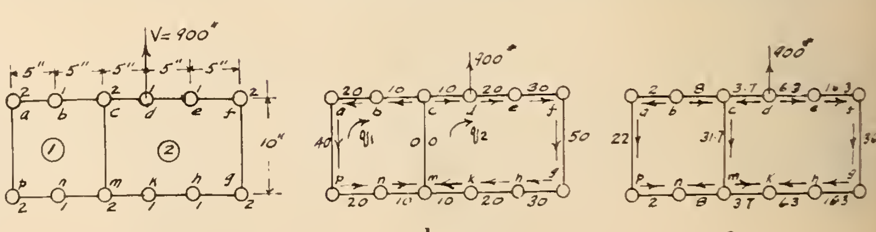


Fig. 8.

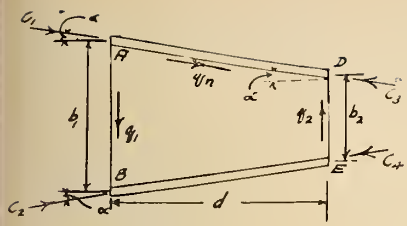


Fig. 9.

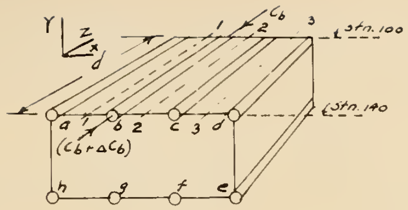


Fig. 10.

twist in each cell can be computed and the results put equal to one another.

For cell 1, using equation 10 with the shear flows on Fig. 8b;

$$\theta_1 = \frac{1}{2A_1G}\int\frac{q.ds}{t} = \frac{1}{2A_1Gt}\int q.ds, \text{ since } t \text{ is constant.}$$

$$= \frac{1}{2\times 100Gt}(-10\times 5-20\times 5-40\times 10-20\times 5-10\times 5+40q_1-10q_2)$$

$$= \frac{1}{200Gt}(40q_1-10q_2-700) \quad - - - - - - - \quad (12)$$

For cell 2;

$$\theta_2 = \frac{1}{2A_2Gt}(10\times 5+20\times 5+30\times 5+50\times 10+30\times 5+20\times 5+10\times 5+50q_2-10q_1)$$

$$= \frac{1}{300Gt}(50q_2-10q_1+1100) \quad - - - - - - - \quad (13)$$

Putting $12=13$, we get;

$$70q_1-65q_2=2150 \quad - - - - - - - - - - - \quad (14)$$

Then taking moments about a convenient point, say d in Fig. 8b, and making use of equation 6b for moments of q_1 and q_2, we have for equilibrium;

$$\sum M = 900\times 0+(50\times 10\times 10)+(30\times 5\times 10)-(40\times 10\times 15)+200q_1+300q_2=0$$

$$2q_1+3q_2=-5 \quad - - - - - - - - - - - - \quad (15)$$

Solving equations 14 and 15;

$q_1=18$ lb./in. and $q_2=-13.7$ lb./in.

Adding these values of q_1 and q_2 to Fig. 8b, we get the final flow pattern of Fig. 8c.

In applying $\sum M=0$ as above to curved sections, equation 6a can be used to find moments of shear about any given point. Actually the quantities in brackets used in deriving equation 15 above are the same as those given by equation 6a.

The final value of the flow in web *c-m* is arrived at by remembering that q_1 is positive in cell 1, i.e. downward on *c-m*, and q_2 is negative in cell 2 which is also downward on web *c-m*. Therefore, both q_1 and q_2 flow in the same direction on *c-m* and are added together, giving 31.7 lb. per in. as indicated in Fig. 8c. The principles applied in this example can be used for three or more cells.

Shear Flow in Tapered Webs

Let Fig. 9 represent a tapered thin web and stringer panel. The stringers are shown in this case as taking compression, but the proof is the same for any other combination of compression and tension. The shear flows q_1 and q_2 are the result of external shear forces acting on the panel. The assumption will be made that the bending moment at AB is greater than at DE so that $C_1>C_3$ and $C_2>C_4$.

$$\text{Shear flow along } AD,\ q_n = \frac{C_1-C_3}{AD} = \frac{\triangle C}{d} \quad - \quad (16)$$

Take moments about E

$$M = C_1.b_2-C_3.b_2-q_1.b_1.d=0$$

$$q_1b_1.d=(C_1-C_3)b_2=\triangle C.b_2$$

substituting value of $\triangle C$ from (16)

$$q_1 = q_n\cdot\frac{b_2}{b_1} \quad - - - - - - \quad (17)$$

These results can be used for determining shear flow in tapered webs. The inaccuracies due to assuming $\cos\alpha=1$ are very small and can be neglected.

In order to determine the shear flow of a stressed skin tapered wing or fuselage, consider two sections fairly close together. Then the force $\triangle C$ in equation (16) for a given stringer will be the difference between the forces on the two sections.

Let Fig. 10 represent a tapered cell subjected to bending from a single load, the end sections being taken at stations 100 and 140, i.e. forty inches apart. The shear flow will be considered constant between stringer skin combinations. The bending moment at station 140 is greater than at station 100. It follows from this that the compressive force $(C_b+\triangle C_b)$ on stringer b at station 140 is greater than the force C_b at station 100.

The average bending shear flow along any section *1-1* will be given by: total shear on *1-1* divided by the distance d. Let q_o be this shear flow on *1-1*. Now, since there will be "shear flow in" at stringer b due to the bending compressive force, the shear flow at section *2-2* is;

$$q_2 = q_o+\frac{(C_b+\triangle C_b)-C_b}{d} = q_o+\frac{\triangle C_b}{d}$$

For section *3-3*, the same process gives;

$$q_3 = q_o+\frac{\triangle C_b+\triangle C_c}{d}$$

$$= q_o+\sum\frac{\triangle C}{d}$$

So that in general for any section *n-n* in the z direction, we can write;

$$q_n = q_o+\sum\frac{\triangle C}{d} \quad - - - - - - - - - - - - \quad (18)$$

These shear flows q_n which are average flows along sections in the z direction between stations, can be converted into shear flows along the x directions *a-b-c*, etc., by means of equations (16) and (17). The process is illustrated in the next problem.

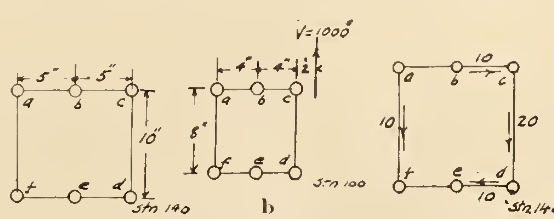
Problem 4.

Let Figs. 11a and 11b represent cross sections of a uniformly tapered cantilever box in which the stringers and effective widths of skin take all the bending caused by the single load $V=1000$ lb. These stringer skin combinations, all of area .5 sq. in., are assumed as concentrated at their centroids, the dimensions between which are as noted. The thickness of skin is taken as .05 in. throughout.

At station 140, $I_x=2(3\times.5\times5^2)=75$.

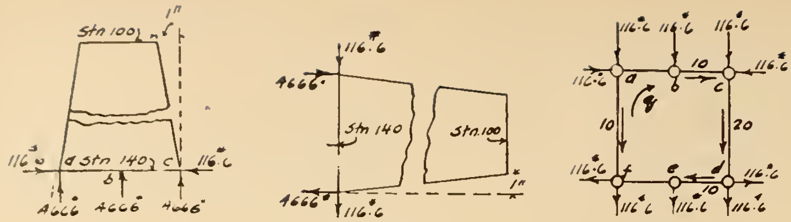
At station 100, $I_x=2(3\times.5\times4^2)=48$.

The bending moments at stations 140 and 100 are



a b c

Fig. 11.



a b c

Fig. 12.

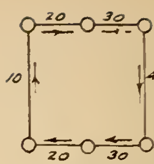


Fig. 13.

respectively $1000 \times 140 = 140{,}000$ in. lb. and $1000 \times 100 = 100{,}000$ in. lb.

Normal stringer stresses at station 140:

$$f_b = \frac{140000 \times 5}{75} = 9333 \text{ lb. per sq. in.}$$

Normal stringer load $= 9333 \times .5 = 4666$ lb.

Normal stringer stresses at station 100:

$$f_b = \frac{100000 \times 4}{48} = 8333 \text{ lb. per sq. in.}$$

Normal stringer load $= 8333 \times .5 = 4166$ lb.

Now if we assume that the normal stringer load due to bending is equal to the load in the stringer direction, since the angle of taper is small, the quantity $\triangle C$ in equation (18) is the difference between the normal stringer loads, i.e. $\triangle C = (4666 - 4166) = 500$ lb.

Assume the shear flow in *a-b* Station 140 as zero in both the X and Z directions. The shear flow in Z direction of *a-b* will be written q_{zab}, the flow in the X direction being written q_{xab}. Use equation 18.

$$q_{zbc} = q_{zab} + \sum \frac{\triangle C}{d}$$

$$= 0 + \frac{(500)}{(40)} = 12.5 \text{ lb./in.}$$

This is the average shear flow in the Z direction of panel *b-c*. To convert this into shear flow in the X direction, i.e. along the right section of station 140, we use equation 17;

$$q_{xbc} = \frac{12.5 \times 8}{10} = 10 \text{ lb. per in.}$$ Then continuing around the section we get;

$$q_{zcd} = 0 + \frac{500 + 500}{40} = 25 \text{ lb. per in.}$$

$$q_{xcd} = \frac{25 \times 8}{10} = 20 \text{ lb. per in.}$$

$$q_{zde} = 0 + \frac{500 + 500 - 500}{40} = 12.5 \text{ lb. per in.}$$

$$q_{xde} = \frac{12.5 \times 8}{10} = 10 \text{ lb. per in.}$$

$$q_{zef} = 0 + \frac{500 + 500 - 500 - 500}{40} = 0.$$

$$q_{xef} = 0.$$

$$q_{zfa} = 0 + \frac{500 + 500 - 500 - 500 - 500}{40} = -12.5 \text{ lb. per in.}$$

$$q_{xfa} = \frac{-12.5 \times 8}{10} = -10 \text{ lb. per in.}$$

(The negative signs for some $\triangle C$'s above are for tension loads). These X plane shear flows at station 140 are indicated in Fig. 11c.

There will be further shear from what are called the "in plane" components of the stringer loads. Consider stringer *a*. The normal stringer load is 4666 lb. as shown in Fig. 12a. This is the Z resolved part of the load in the actual stringer direction. The X resolved part of the stringer load is, $C_x = \frac{4666}{40} = 116.6$ lb., since the slope of the stringer is one in forty. There will be a similar X resolved part at stringer *c* acting in the opposite sense. There is no X resolved part for stringer *b*. A similar condition exists on the tension side but the forces will act in the opposite sense. Now if we consider the *Y-Z* plane, we see that the stringer loads all have resolved parts in the Y direction, the magnitudes being 116.6 lb., as shown in Fig. 12b.

All these "in plane" components due to slope of the stringers are shown in Fig. 12c, together with the shear flow values determined so far.

There will be a constant shear flow q around the section, due to the external load not acting through the shear centre, thereby giving a torsional couple as well as bending effect. This constant shear flow q has been assumed positive as shown in Fig. 12c.

If now we take moments about any convenient point, say *a*, we have for equilibrium;

$$\sum M = -1000 \times 10 + 20 \times 10 \times 10 + 10 \times 5 \times 10 + 2 \times 116.6 \times 10 + 2 \times 116.6 \times 5 + 2q \times 100 = 0.$$

$$q = 20 \text{ lb. per in.}$$

Adding this shear flow to that of Fig. 12c, we get the actual shear flow shown in Fig. 13.

This method of determining shear flow from normal stringer load differences has several advantages when considering unsymmetrical sections such as used for aircraft wings. It is not necessary to determine the principal axes. Any convenient centroid X and Y axes can be used and the bending stresses in the stringers found by the following relations where M_x and M_y are the given bending moments about the X and Y axes respectively;

$$f_b = -(K_3 M_y - K_1 M_x)x - (K_2 M_x - K_1 M_y)y$$

where $K_1 = \dfrac{P}{(I_x I_y - P^2)}$

$$K_2 = \frac{I_y}{(I_x I_y - P^2)}$$

$$K_3 = \frac{I_x}{(I_x I_y - P^2)}$$

P = Product of inertia.

The neutral axis location can be found by:

$\text{Tan}\phi = -\dfrac{K_3 M_y - K_1 M_x}{K_2 M_x - K_1 M_y}$, where ϕ is the inclination of the N.A. to the X axis.

In using these relations, bending moments which cause compression in the first quadrant are called positive. Then a negative result for f_b indicates compression in the stringer concerned. If the structure has very little or no taper, this method can still be used with certain simplifications. The "in plane" forces either do not exist or can be neglected. The method is then a modification of equation 3. *(Continued on page 433)*

RADIANT HEATING AND COOLING APPLIED TO PREFABRICATED FLOORS AND CEILINGS

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A paper presented before the Montreal Branch of The Engineering Institute of Canada, April 10th, 1947.

This paper reviews the fundamentals of radiant heating and cooling and describes present day practice in design and installation of such systems and their controls. The installation and operation in a number of residential, commercial and industrial buildings now erected or under construction in Canada is covered. Recent Canadian developments in prefabricated floor and ceiling construction, incorporating radiant heating and cooling along with other usual electrical and mechanical services generally installed in modern commercial buildings are dealt with.

Although radiant heating in a crude form was used by the Romans to heat their great public baths over two thousand years ago, in its modern adaptation it is today considered to be the latest development in heating practice. In its present form radiant heating was conceived and patented fifty years ago by Prof. A. H. Barker, an eminent English heating authority. Prof. Barker sold his patent to the firm of Richard Crittall & Company Ltd., who developed and marketed the system which became known as the Crittall System of panel warming. The author's first experience with radiant heating goes back to 1929, when an installation in two bathrooms was designed by the author and installed in a large Westmount residence. This installation utilized pipe coils in the bathroom floors below the floor tiles. It proved to be satisfactory and has been in operation ever since.

Fifteen years ago almost to the day, the author presented a paper entitled, " Modern Developments In Heating Practice " before the Montreal Branch of the Institute. It was published in the October 1932 number of the *Engineering Journal*, dealt with radiant heating at some length, and expressed doubt if radiant heating would ever be commonly used in Canada because the cost of such systems would probably be prohibitive. That was the opinion held fifteen years ago by the few engineers here who investigated radiant heating. Most Canadian engineers probably still hold this view. The paper referred to does demonstrate, however, that radiant heating is not as new here as many people believe.

Over two years ago, the author and his staff designed what was until recently the largest radiant heating system in operation on the North American continent. This installation is described in the March 1947 issue of *Heating, Piping and Air Conditioning*.

A sufficient number of installations have now been made from our designs to give us wide experience with the installation of such systems, and to enable us to verify our design figures. These demonstrate that the performance of radiant heating under various conditions is satisfactory in this climate, and that in most cases the cost of a well designed system in Canada is comparable in cost to equivalent heating systems of other types.

Fundamentals

One reason why confusion exists regarding radiant heating is that so many people think all heating systems convey their heat by convection only. They do not understand how heat can be transmitted by radiation. It is therefore necessary to define what is meant by the terms convection heat, radiant heat, and so forth.

CONVECTION: As is generally known, heat is conveyed by convection. Air in passing over a warm object becomes heated, expands, and so becomes lighter, thus it rises and causes a circulation of the air in the enclosure. When the air thus circulated comes in contact with a cooler object it gives up some of its heat and becomes heavier, thus sinking and assisting the air movement already set up. The quantity of heat conveyed by convection varies, amongst other things, with the average temperature difference between the surfaces of the objects and the surrounding air, with the shape and size of the objects, and with the rate of air motion over them.

RADIANT HEAT: In contrast to this, heat is transmitted by radiation from a warm object to a cooler one by electromagnetic waves, which are transformed into heat when intercepted by the cooler object. These waves are similar to light rays, they travel at the same speed and may be reflected or absorbed in the same manner. Radiant heat waves pass through air without affecting its temperature and are independent of the temperature and movement of the air. The quantity of heat transmitted by radiation depends on the difference of temperature between the objects, the emissivity of the surfaces of the two objects, and on the geometrical arrangement of these surfaces.

In practice, no warm object transfers its heat to a cooler one entirely by convection or solely by radiation. For instance, warm air heating systems and steam or hot water systems, having concealed convectors, dissipate most of their heat by convection. An exposed cast iron radiator dissipates about 30 per cent of its heat output by radiation, and 70 per cent by convection, while a radiant heating system utilizing ceiling coils dissipates about 72 per cent by radiation ,and 28 per cent by convection. The figures for radiation from radiant heating systems having wall coils and floor coils are 59 per cent and 52 per cent respectively.

CONVECTION HEATING SYSTEMS: In a building heated by means of a warm air furnace, or by a hot water or steam system having either exposed radiators or concealed convectors, the heating system imparts its heat directly to the air in the building and the air then heats up the floor, wall and ceiling surfaces, so that these heating systems are all of the convection type.

RADIANT HEATING SYSTEMS: Radiant heating systems are those in which the heating units (usually pipe coils) are embedded in the floor, wall, or ceiling surfaces so that the heating units transmit their heat directly to the surfaces in which they are embedded and which by the flow of radiant heat warm up the remaining interior surfaces of the room, and these by convection then raise the temperature of the air in the room.

Radiant heating may be of the high temperature or low temperature type, depending on the temperature of the radiating surfaces. Low temperature radiant heating is generally considered to be one whose radiating surfaces do not exceed 130 deg. F. While high temperature radiant heating may be useful under certain conditions, it is in general undesirable for most building heating. Consequently most systems are of the low temperature type, and it is to this type that all further reference will be made in this paper. The comfort and economic operation of a radiant heating system depends to a large extent on the success of the designer in producing a system which heats predominantly by radiant heating, rather than by convection.

COOLING SYSTEMS: In the same way that buildings are heated either by convection heating or by radiant heating, they may also be cooled by either convection (as in summer air-conditioning systems) or by radiant cooling. In a radiant cooling system chilled water is circulated through the pipe coils embedded in the building surfaces, which by the absorption of radiant heat, cool off the remaining floor, wall and ceiling surfaces, and, by convection, then lowers the temperature of the air in the room.

MEAN RADIANT TEMPERATURES: An expression commonly used in radiant heating and cooling is the term " mean radiant temperature." The mean radiant temperature of an enclosure may be calculated approximately by multiplying the area of each interior surface of that enclosure by its surface temperature and then dividing the sum of these by the sum of all the areas. Actually the mean radiant temperature of the interior surfaces of an enclosure is found by multiplying the several surface areas by the fourth power of their respective absolute temperatures, dividing the sum of the resulting products by the sum of the areas, correcting for the emissivities of the surfaces, extracting the fourth root of the quotient and deducting 460 from the result. In practice it is usual to find the mean radiant temperature by the use of radiation tables, which greatly simplify the calculations.

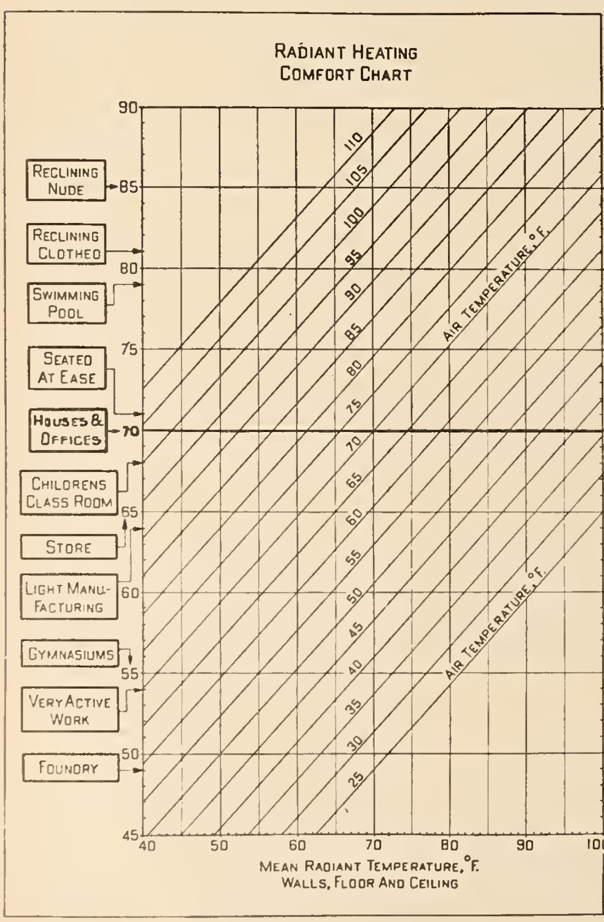

Fig. 1.

Function of a Heating System

In practice with either convection heating or radiant heating, both the air temperature and the mean radiant temperature are usually maintained between 65 deg. F. and 75 deg. F. Consider for a moment the average male, who has a height of 5 ft. 8 in., weighs 150 lb., and has a surface area of 19.5 sq. ft. It is said that the average surface temperature of the clothing and exposed surface of a normally clothed male is 81 deg. F. It is therefore obvious that, with the air temperatures and mean radiant temperatures found in practice, the heating system in a building does *not* heat up the occupants. It should however maintain such an air temperature and such a mean radiant temperature as will provide optimum conditions for those occupants. The optimum conditions are really dependent on the sex, age, amount of clothing and degree of activity of the occupants.

In practice the conditions are usually designed to best suit the average occupant. On this basis the conditions that should be maintained in buildings are shown graphically in Fig. 1. From this it will be seen that the same degree of comfort can be maintained in an enclosure having a low air temperature and a high mean radiant temperature, as can be maintained where these are just the reverse. It is obvious too that constant comfort conditions cannot be maintained throughout the heating season by maintaining the air temperature constant and allowing the mean radiant temperature to vary, yet this is attempted by most convection heating systems today.

Advantages of Radiant Heating

In a building heated by means of convection heating, the temperature of the air in the building must be higher than those of the interior surfaces of the building. The colder it becomes outside, the greater is this difference. Besides this, in such systems the temperature of the air at the ceiling will always be considerably higher than at the breathing line, and the temperature of the air at the floor will always be materially lower. This temperature gradient will be more pronounced in extremely cold weather than in moderate weather. It is much more pronounced in such places as auditoriums, churches, high industrial buildings, etc.

In any event, the floor temperature in any high building heated by convection, will always be definitely colder than the air at the breathing line, at which level the temperature is usually held constant by the thermostatic control system of the building. The resulting conditions are those which should be avoided in winter in this climate, namely relatively higher room air temperatures, with the head warm and the feet cold.

It has been definitely proved by experience that a room is more comfortable and healthy if walls, ceilings, and especially the floor are warmer than the air

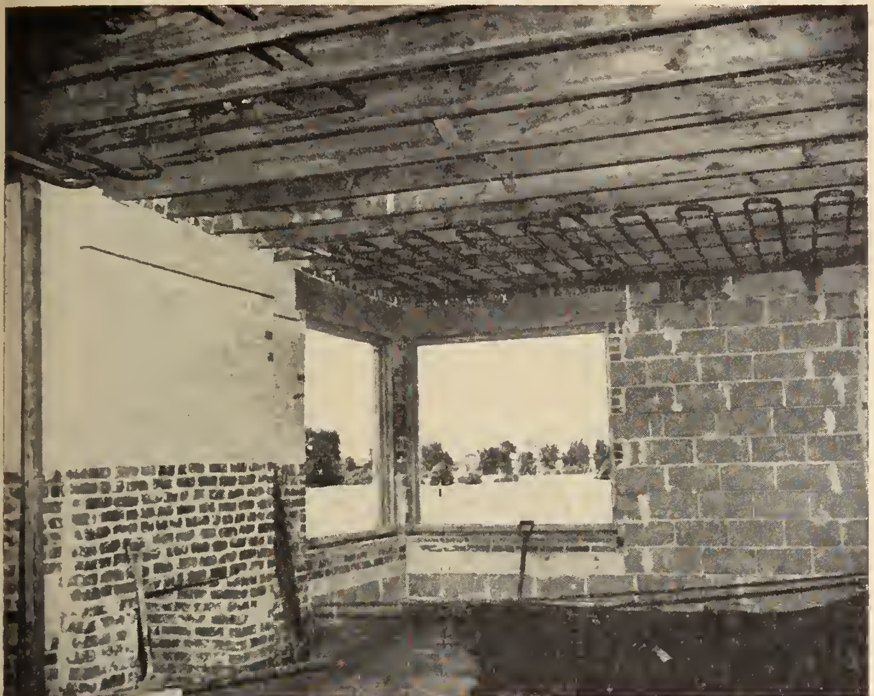

Fig. 2a—Corner of living room before finishing—ceiling type radiant heating.

in the room; also, that within the range of 65 deg. F. to 75 deg. F., for the same feeling of warmth, the lower the air temperature the greater will be the sensation of comfort.

In a building heated by means of a radiant heating system, especially where the heating panels are in the ceiling, the air temperature of the building is generally lower than that of the mean radiant temperature of the interior surfaces. Furthermore the temperature gradient between the air at the ceiling and that of the floor is very slight, even in rooms having very high ceilings. This temperature gradient does not vary appreciably with the variation in the exterior weather conditions. It is so slight that practically no movement of air in the room is noticeable with radiant heating systems, and so no dust is lifted up and carried around the room.

The fact is that room air temperatures can be, and usually are, lower with radiant heating systems than with convection systems, and the interior surfaces of the exterior walls are at higher temperatures. In buildings without humidifiers the relative humidity of the air is considerably higher than it would be with convection heating systems. Because lower air temperatures are maintained with radiant heating than with convection heating, the heat loss due to infiltration and to ventilation is geatly reduced. The shock effect experienced on coming in contact with cold air outside in our cold winter weather is less when leaving a radiant heated house. Another advantage of radiant heating is that the energy absorbed by the skin from the impinging radiant heat rays has a beneficial effect on the nerves under the skin, which, with higher relative humidities, keeps us healthy and rejuvenated.

A further great advantage of radiant heating is that it acts to offset the cooling effect of windows, particularly large ones. A window, while acting as an opening through which light enters, is one of the greatest sources of heat loss from a room. In rooms heated by radiators or convectors only, it is possible to prevent the occupants of the room from being annoyed by cold draughts from the window by adopting the principle of installing the radiators or convectors under the windows. Where the windows are large, the radiators or convectors should be preferably as long as the windows are wide. On the other hand, radiant heating makes it possible to compensate directly for the heat losses from the windows, which can be carried down to the floor. In this case there is no heating equipment to interfere with full-length draperies.

In addition, radiant heating, except for the equipment in the boiler room, has the advantage of being entirely concealed, and so does not involve any unsightly registers, radiators or other exposed heating equipment. Figure 2 shows the corner of the living room in a residence having radiant heating of the ceiling type. Thus the rooms heated by radiant heating can be designed to suit the architectural treatment or interior decoration desired, without having to make special arrangements for warm or return air registers, radiators, concealed convectors, or for duct or pipe chases, etc. Radiant heating is installed before any interior finish is started, hence the heating sys-

Fig. 2b—The same room after finishing.

tem can be utilized to furnish the heating required during the construction period, without providing any temporary heating.

Those not familiar with the experience on closed hot water heating systems frequently refer to the possibility of corrosion of the pipe coils buried in the building construction, especially in the concrete slabs. Years of experience with all types of hot water heating systems show that practically no corrosion takes place in such systems. This is because when the system is first filled with water the corrosive elements in the water cause a slight corrosion and these elements are used up, so no further corrosion then takes place. Furthermore, radiant heating systems are operated at temperatures sufficiently low to prevent the release of the semi-bound gases in the water which would prove actively corrosive. Any possibility of external corrosion of the pipes can be neglected, as long as no cinders are used as a base for the concrete in which they are embedded.

Well Suited for Dwellings, Hospitals, etc.

Radiant Heating is eminently satisfactory for the modern basementless house, which has been out of the question in this climate up until the advent of radiant heating. In such construction, by embedding radiant heating pipe coils either in the ceiling or floor surfaces, cold damp floors are entirely eliminated. Figure 3 illustrates such a building constructed in St. Hilaire, Que., last year. It is equipped with a ceiling type radiant heating system.

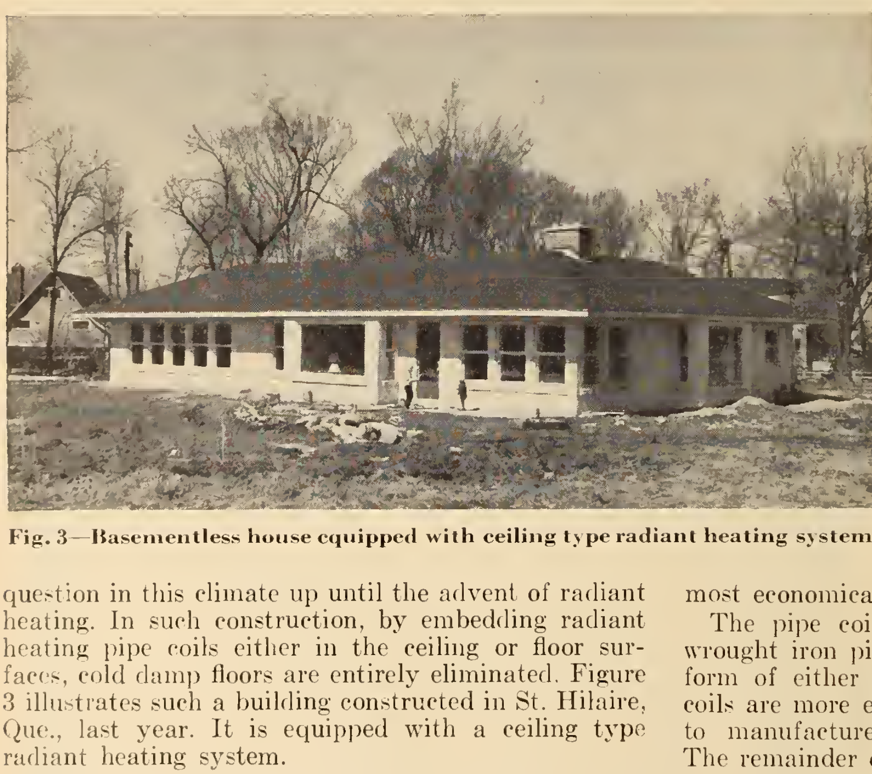

Fig. 3—Basementless house equipped with ceiling type radiant heating system.

Radiant heating systems are ideally suited for the heating of hospitals, sanatoria, convalescent homes and schools. In such buildings the control of dust is important in minimizing the spread of airborne disease or contagion. In them the ventilation load may represent a high percentage of the total heating load. This is because radiant heating can maintain comfortable, healthy temperatures and reasonable relative humidities in such buildings without the convectional circulation of air carrying dust (and so probably airborne bacteria) and without the existence of inaccessible dust-collecting surfaces in such systems. They can do this with lower room air temperatures. Consequently they effect very substantial fuel savings in such buildings, due to the reduced infiltration and ventilation losses. The number of exceptionally large installations in this type of building in England and on the Continent bear this out.

Present Day Radiant Heating Practice

Radiant heating may be accomplished by utilizing hot water, steam, warm air or electricity as the heating medium. The majority of the systems installed today however are designed with hot water as their heating medium and with pipe coils embedded in the floor, wall or ceiling surfaces. Some confusion has arisen as to whether it is preferable to install the coils in the ceiling or in the floor. It might be well, therefore, to consider the difference between these two positions.

For the same mean radiant temperature, the same panel surface temperature and the same air temperature, a floor panel will give a greater total heat emission than a ceiling panel. Yet in practice it is undesirable to carry a floor surface temperature higher than 85 deg. F., while a plaster ceiling may be heated to 120 deg. F., without causing discomfort. On the other hand, if the ceiling is to be covered with a wood-fiber acoustic board, since such fiber board is a splendid heat insulator, it would probably be better to use floor coils. In buildings having either bare or linoleum covered floors, it is probably cheaper to use pipe coils buried in concrete rather than in the plaster ceiling.

When the pipe coils are embedded in the floor, pipes must be distributed more or less uniformly over the entire floor. It is usually desirable to reduce somewhat the spacing between pipes near to the exterior walls. On the other hand, when the pipe coils are buried in the ceiling surfaces they need not be distributed over the entire ceiling. This is because the occupants do not come in contact with the ceiling or close enough to it to detect differences in ceiling surface temperatures. Ceiling coils may then be made up to give the most economical construction.

The pipe coils are usually made up of steel or wrought iron pipe, or of brass or copper pipe in the form of either sinuous or grid type coils. Sinuous coils are more efficient than grid coils, and are easier to manufacture by quantity production methods. The remainder of a radiant heating system is similar to any other forced hot water heating system. Any hot water boiler or heater may be used, employing any fuel the user desires.

The remainder of the installation consists of the necessary flow and return piping, shut-off and balancing cocks, and an expansion tank. It will include one or more circulating pumps and a temperature control system, which may be anything from a simple inexpensive system up to the most expensive and highest grade of thermostatic control. Whatever control system is used, there should be continuous flow of water at a variable temperature through the pipe coils. Undoubtedly the best control is that utilizing a water temperature controller in the flow main to the coils, reset or compensated by means of an outdoor thermostat. The temperature controller and the thermostat should both be of the modulating type.

Radiant Cooling Systems

A radiant cooling system is similar to a radiant heating system, but a cooling unit is used in place of the heater. For radiant cooling systems the pipe coils should preferably be embedded in the ceiling plaster, except in hospital operating rooms, when they should be built into the walls.

Radiant cooling systems may be the sole means of cooling an enclosure. They may be combined with suitable dehumidifiers, or with conventional summer air conditioning systems, because the ceiling or floor surfaces cannot be used to dehumidify the air in the buildings in which they are installed. But used in conjunction with a dehumidifier or with a conventional summer air conditioning system, the radiant cooling system may be utilized to do all or part of the sensible cooling, while the dehumidifier or the air conditioning system will cool and dehumidify both the air in the room and the fresh air supplied to it.

This latter combination has many advantages over a straight summer air conditioning system, and would undoubtedly eliminate many of the faults of present day air conditioning installations. Unfortunately space does not permit of a fuller discussion of radiant cooling systems. It should, however, be pointed out that combining radiant cooling with a conventional summer air conditioning system will provide more uniform room temperatures, a substantial reduction in the size of the ductwork and of the air conditioning equipment, and a reduction in the air circulated in the enclosure. It will undoubtedly have a lower operating cost than ordinary summer air conditioning systems.

The National Research Council has constructed two special test houses in Ottawa for investigating some of the problems encountered in radiant heating in this climate, and for initiating research on certain phases not previously investigated. Such research work will be of material assistance to Canadians interested in radiant heating and cooling. We have already benefited from the assistance received from Dr. C. D. Niven of the National Research Council, and this, with the technical data, private communications and the personal assistance we have received from the Richard Crittall & Co. Ltd., of London, England, Dr. F. E. Giesecke of Texas, Prof. F. W. Hutchison of Purdue University, and Mr. Chas. A. Hawk Jr. of the A. M. Byers Co. of Pittsburgh, has enabled us to design radiant heating systems to suit the Canadian climate and Canadian methods of construction.

Prefabricated Floor System

Our early experience with radiant heating demonstrated that where pipe coils were embedded in reinforced concrete slabs, they generally interfered with the placement of the reinforcing rods. Frequently the rods had to run right beside the radiant heating pipes. It appeared possible to use the radiant heating pipes as reinforcement. Considerable research has been done on this subject in Texas and in Switzerland, showing that the pipes can readily be used either as reinforcement or as part of the building structure as well as for heating. This implies close cooperation between the structural designer and the heating engineer, but closely coordinated designs would undoubtedly result in the overall cost of the building being kept to a minimum.

Early last year, C. S. Kane, M.E.I.C., a structural engineer, cooperated with the author in finding a method of combining the radiant heating design with the structural design so the latter could be made to suit the heating installation, and best advantage taken of the structural properties of the pipe coils.

It was decided to depart from the conventional one-way system of floor joists, in favour of a two-way system with the pipe coils so incorporated in the structure that they also serve as part of it. The idea lent itself admirably to prefabricated construction. After reviewing all available literature on the subject, a search was made of the patents issued that might limit such an idea. Finding no evidence of any prior patents, a set of preliminary drawings was prepared and a scale model made up. The design was then discussed with steel joist manufacturers, with structural steel fabricators and with leading contractors, resulting in certain modifications being incorporated in the design.

Finally, detailed working drawings of prefabricated panels for a single bay of a new office building were prepared, with the panels designed to be made up to incorporate the necessary radiant heating, the lighting ceiling outlets, a system of underfloor ducts for telephone wiring, and automatic sprinkler piping. Then with the cooperation of the manufacturers three cages were made up. These are shown in Fig. 4. One cage in the foreground is complete with underfloor ducts, pipe coils and the metallic lath. These cages, when plastered and concreted, will form the three prefabricated panels for the bay referred to.

The fabrication of these three cages demonstrated

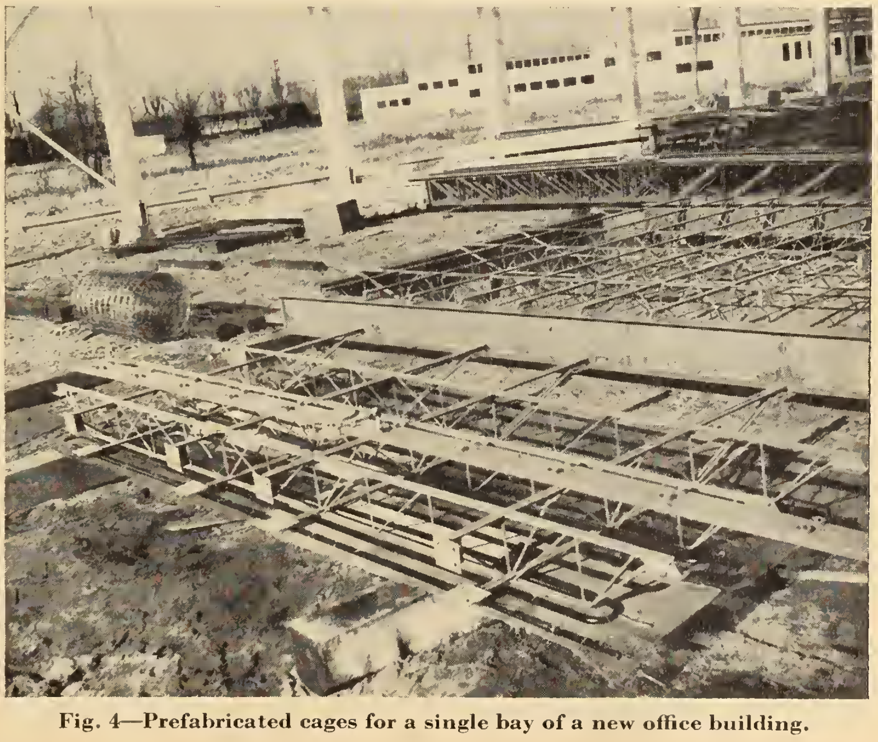

Fig. 4—Prefabricated cages for a single bay of a new office building.

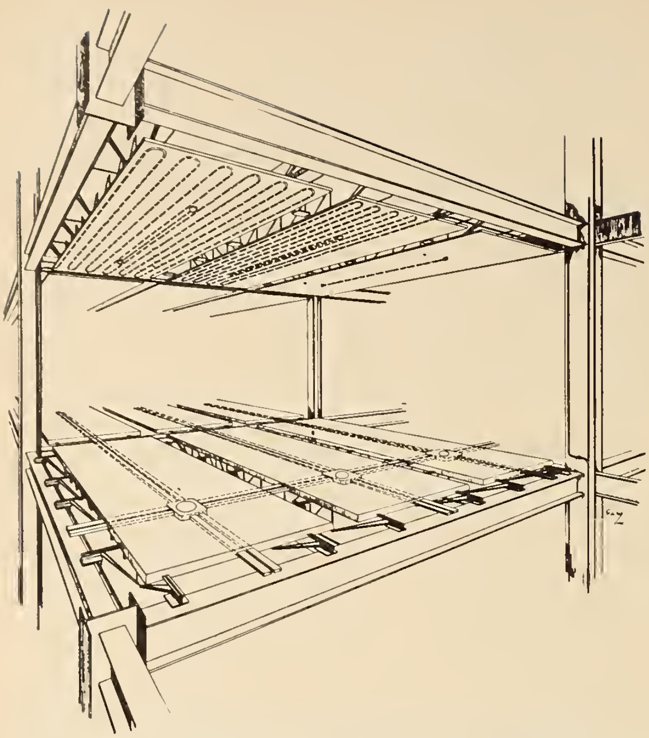

Fig. 5—Typical installation of the prefabricated panels in place on the structural steel of an office building.

the ease with which primary and secondary steel joists could be fabricated and then assembled into cages, and that electrical and mechanical services could be readily incorporated. The cages may be shipped to the job, placed in position and then have the concrete floor slab poured in place. This method is believed to offer the greatest advantages with present day shortages of both skilled and unskilled labour and materials.

Figure 5 shows a typical installation of the prefabricated panels in place on the structural steel of an office building. The two columns on the left represent columns in an exterior wall of the building.

It will be seen that three panels are installed in each bay, in this case with the joists resting on top of the steel girders and with the plaster ceiling flush with the bottom flanges of the girders. Both ends of each of the primary joists rest directly on the steel girders. One end of each of the secondary joists of the end panels rests on the steel girders, while the other end is securely fastened to the companion secondary joist in the centre panel. In the floor view the shear and compression connection in the secondary joists may be observed in the space between the first two panels. In the ceiling view the tension connections in the secondary joist may be seen in the same relative space.

It will be observed that sufficient space is provided between each of the end panels and the centre panel of each bay so as to allow all the connections between the panels to be made up readily. Also ample space is provided between all panels and the adjoining girders so as to allow the steel erectors to properly guy the structural steel during erection and to rest their hoisting equipment directly on the girders. Furthermore the panels do not interfere with the use of the steel girders to support the staging used by the men rivetting or welding the structural steel and that used by the masons setting exterior walls. None of the open spaces is wide enough to allow anyone to fall through.

The radiant heating and cooling pipe coils are shown embedded in the plaster sections or ceiling surface of the outer two panels.

Two electrical ceiling outlets, with the connecting electric conduit, are also shown in the plaster section of each panel. On the ceiling surface of each end panel two small crosses have been drawn to illustrate the locations of sprinkler heads, when the panels also have automatic sprinkler piping incorporated in them.

In the concrete floor slab of each panel is shown a pair of electrical underfloor ducts or raceways running parallel with the exterior wall. These underfloor ducts are joined together by means of a pair of feeder and cross-over ducts, with appropriate junction boxes at the intersections of the ducts. Of each pair of underfloor ducts, one is utilized to carry the telephone wiring and the other the 110 volt service. Thus after the building has been completed, desks located over the underfloor ducts may readily be provided with telephone and 110 volt service by simply cutting into these ducts.

The panels are designed so that they can be prefabricated in a suitable plant or plants, transported to the building in which they are to be installed and hoisted into place by the structural steel erectors. The connecting plates between adjoining panels are then welded or otherwise securely fastened together and the bearing plates at the ends of the primary and secondary hoists are then welded to the steel girders on which they rest, thus forming the separate panels into one coordinated section of the floor.

After all the electric and mechanical services in the panels have been connected to those of the remainder of the building, the spaces between adjoining panels are filled in with reinforced concrete and the necessary fireproofing is poured or placed around the steel columns and the girders. Finally, the cement finish is put on the floor slabs and the white coat is trowelled onto the ceiling plaster, thus completing both the floor and ceiling with a minimum of on-the-site labour.

In some cases it may be desirable or necessary to install the bare cages in the building and to pour the reinforced concrete floor after the cages have been secured in place, followed by the plastering of the ceiling.

Advantages of Prefabrication

Because the panels may be prefabricated at the same time that the structural steel frame of the building is being fabricated, buildings utilizing prefabrication will without doubt be erected faster than buildings of conventional construction. Prefabrication makes most efficient use of the steel and concrete used, utilizing the floor slab not only as a fireproof deck but also as a portion of the compression members of the joists. The piping serves not only as radiant heating but as supports for the metallic ceiling lath as well. Prefabrication reduces the amount of form work. It eliminates shoring and reduces the scaffolding required by general, electrical and mechanical trades, thus reducing the fire hazard during construction.

By placing the prefabricated panels concurrently with steel erection, the necessity of placing temporary wood staging is eliminated, or planking for protecting the steel workers. It also provides adequate storage

(*Continued on page 438*)

SHALL HIGHER EDUCATION BE EXPANDED ON THE TECHNOLOGICAL PATTERN?

WILLIAM E. WICKENDEN

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On August 31st of this year Dr. Wickenden retired from the presidency of Case School of Applied Science and the field of engineering education has thereby been deprived of the active services of one of its most distinguished leaders. If his retirement permits Dr. Wickenden to devote additional time and energy to the composition and publication of such superlative works as "The Second Mile" and the treatise here reprinted, the profession may not count itself the loser.

Believing that outstanding ability in the construction of the English language is too rarely associated with similar ability in the construction of engineering works, the Journal earnestly recommends this latest of Dr. Wickenden's works to its readers—not to be lightly skimmed over but to be studied with minute attention to the thread of the argument and the delightful manner of its presentation. Those engineers who, at times, have experienced doubts regarding the methods and values of their technical education may find ample reassurance in these authoritative statements. So, also may those detractors of the trend in technical education find in Dr. Wickenden's words, logic so sound that they may be induced to modify their opinions.

In the light of events it appears that the issue between a stratified and an integral plan of education for the technological professions was settled twenty years ago in favor of the latter. By a stratified program is meant the two stages which have become traditional in the training of physicians, dentists, lawyers, and clergymen, the first including only general studies in the arts, sciences, and humanities, and the second devoted entirely to technical training for the profession proper. This issue was considered at length in the extended investigation of engineering education of 1923-29, and subsequent reports have developed and numerous acts have confirmed the decisions taken at that time. Furthermore, the intervening years have seen a pronounced swing of opinion toward the ideals and patterns of education which the engineering curriculum exemplifies. What was once regarded as a variant is now being regarded more and more as a modal type. If the great expansion of higher education predicted for the next decade is actually realized, it seems likely that much more of it will follow the mode established in engineering, at least in its general plan and outline, than the older traditions of the liberal arts. This prospect may give some timely significance to a discussion on general lines of the relation which the technological curriculum bears to general education.

It must be apparent to all that while technological education has grown more assured in its goals and processes, liberal education has been increasingly on the defensive, not only as to its organization and content but also as to its function as well. The recent war accentuated this contrast, but the underlying condition had been long in the making. To the author, these trends reflect the course of evolution through which American culture has been passing. Two world wars have served to heighten our sense of political, economic, and military interdependence with Europe, but equally have tended to increase our sense of cultural and technological self-sufficiency. It may be questioned, of course, whether we have yet achieved a distinctive American culture, that indefinable but very real something which could differentiate us from other peoples as definitely as a Frenchman is differentiated from an Italian or a Hollander from a Swede. Nor has that "something" yet fully developed its characteristic symbols or forms of expression in our language, literature, art, music, or philosophy.

It was the endeavor to transplant a traditional culture which brought American education into being. Fearful lest their children should be cut off in the wilderness from the classical past which Englishmen of the seventeenth century had inherited through the Renaissance and the universities of the Middle Ages, and left without a learned ministry and magistracy, the fathers of Massachusetts Bay modeled Harvard on the pattern of Emmanuel College at Cambridge from which so many of their number had come. The goal and pattern thus established has continued as a dominant but gradually receding ideal in the liberal colleges of America for two centuries and more. In the light of today the idea of transplanting a traditional culture to American soil has not precisely failed but has progressively gone to seed, leaving our liberal education in unmistakable need of a redefining of its function and reorienting of its goals.

Meanwhile American life has shown signs of evolving a vigorous cultural pattern of its own. Turning away from the older pattern with its aristocratic detachment from the world of work, we have been fashioning an indigenous culture out of the very needs, strivings, and aspirations of our contemporary technological civilization. This culture of ours has not yet fully developed its characteristic symbolic forms, but we find hints of them in our functional architecture, in the eye-satisfying catenary cable and structural tracery of a modern suspension bridge, in the sleek streamlining of our more advanced air, land, and water craft, and in a thousand other familiar ways. Why should these characteristic expressions of our times be thought less significant culturally than the classical column and dome or the Gothic vaulting and buttresses of past ages that were limited to a structural art which employed only compression members? Why should the American Society of Mechanical Engineers in our day be thought a less worthy medium of cultural expression than Hans Sachs and the guild of shoemakers in the Nuremberg of *die Meistersinger*?

This is, of course, a bridge to be built between the domain of technology and the domain of culture. Technology is impersonal, material, logical, and economic, whereas culture is human, spiritual, imaginative, and above all money reckoning. Technology has to do with means, culture with meanings. Technology speaks in a technical vocabulary, culture in a universal language of symbolism. What education needs is not a divorce but a bridge between the two. The ideal span may be likened to a cantilever, to be built outward from both sides, member by member. In order that the two converging sections may make a perfect juncture it is important for the engineer to know the meaning of literary and art forms, but it is just as important that the man of art or letters should know the fundamental meanings of technology. To interpret them in terms that all may understand should be one of the major cultural contributions of the engineers of our generation. One does not gain these ends by isolating either cultural or technological education.

A decade ago many educators thought that the sequestering of professional training at the graduate level was a closed issue. Now they are not so sure of it. Even doctors and lawyers are questioning whether they may not have gone too far in dissociating general from functional studies and in imposing time demands which prompted Stephen Leacock's ironic observation that "education is eating up life." And then there is the irrepressible Mr. Hutchins, who sees himself as the savior of liberal education and not as the destroyer of its temples. He sees liberal education being squeezed into extinction between the stretch-out in the secondary school and insatiable time demands of the graduate professional school. He proposes to save liberal education by saving time, that is by squeezing what he calls "the water, waste, and frivolity" out of the final years of high school and the early years of college, where we Americans now indulge our pet propensity for artificially prolonging adolescence. If Mr. Hutchins and other educators generally can do what he thinks he can do under this plan and give convincing proof of it, many engineering educators would be inclined to go along with him. Most of them, however, remain skeptical —the incurable Philistines, no doubt!

Enlightened engineering educators would like to do their part, too, to save the liberal education; while they are interested in saving time, their greater concern is to save culture from isolation. They would destroy rather than erect barriers between the humanities, the sciences, and the technologies. They are convinced that life cannot be lived in any such artificial compartments. Occupation and citizenship, competence and culture, professional integrity and ethical sensitiveness, technical skill and human understanding are all strands in what should be the inextricable warp and woof of an engineer's daily life. This group is therefore not apologetic but outspoken, even militant, in its advocacy of a unified humanistic-social and scientific-technological curriculum.

They grow more convinced that this general type of education deserves to be extended beyond the present limits of engineering education. What confirms them in this conviction is the observation that there are apparently two modal types of young people and that somewhat different modes of education are needed to serve them best. To state it simply, one group includes those whose career goals come into focus relatively early in adolescence, and the other those whose career goals come into focus relatively late.

It would need a psychologist of the Terman magnitude to put this hypothesis to a full test and to classify young people in the two general groups, rather than a mere engineer. General observation would lead the author to believe, however, that most young people who are drawn naturally to scientific careers fall in the first category, while many who are drawn to careers based on human relations and the social services fall naturally into the second category. There seems to be some warrant also for the belief that the peak of individual productivity in a scientific career comes earlier in life than the peak of philosophic wisdom or practical capacity for dealing with human relations and affairs. The truths of science, while sometimes difficult to grasp conceptually or express mathematically, are after all fairly definite and explicit, while almost every aspect of truth having to do with human nature and society is shrouded by conflicting evidence and clashing values. If these ideas are true, there may be sound warrant for beginning career-directed education in the sciences at an earlier age than in the realms of human service and relationships.

At any rate, we in the technological institutions know that we have to do with young people whose career goals have come into focus early and who are strongly motivated by this fact. From every available indication, they are equally worthy in character and equally gifted in endowment with the best of our youth. They are ready to give to their education an intensity of effort substantially beyond that commonly prevailing in college circles. They are quite willing to give a substantial part of their time and effort to studies of a most general character—language, literature, history, economics, geography, psychology, government, music, and art — provided the strongly motivating career interest is not denied its natural and proper outlet. Not infrequently interest in the general stem of the curriculum grows with increasing maturity, as the student's desire unfolds to see technological activity in its setting of human and social significance. It is not uncommon for seniors to give time and effort more willingly than freshmen to matters of social and cultural interest.

In the author's opinion much of the complaint voiced by teachers of English and history drawn from arts faculties over their experience with engineering students arises from the fact that these teachers take for granted that all students taking their subjects are supposed to be premotivated. Their complaints often reveal an unwillingness to employ the arts of salesmanship or to relate the subject in a functional manner to the student's major field of interest. Teachers of humanistic subjects in technological institutions usually have little difficulty from this source; either they accept their students' major interests and seek to build upon them or transfer to other institutions. Once adjusted, they find the high general level of application throughout an entire class a fair compensation for the absence of the occasional brilliant student planning to major in the subject, who is so often a saving remnant in the liberal arts.

There are, of course, those who insist that this sort of thing is not education at all. Quite often these are the people who also insist on an exclusive right to make their own definitions, like a recent protagonist who wrote:

> For myself, I do not see what else can educate a man but the liberal arts. He can be trained, he can be professionalized, he can be specialized, he can be individualized and he

can be contemporized, but he cannot be educated unless he is educated in the liberal arts.

This, of course, is simply question-begging rhetoric. One prefers the forthright dictum of Mr. Hutchins:

An educational system which does not make the questions of what is ultimately good and bad in human life the center of its attention is not an educational system at all. It is a large-scale housing venture.

If all who choose to link their education to their chosen work have missed the very essence of education entirely, let us be content to take the substance and let the shadow of definition go.

We sin against youth when we keep them so long in college that education—to return to Leacock's phrase—eats up life. No one wants to return to the good old days, to quote Leacock further, "when two years in a saw mill and two in a medical school made men doctors, or one in a saw mill and one in divinity fitted them for the church," but plain sense tells us that the times are out of joint when young people in their thirties are just beginning their active professional careers. When we insist that young folk must be so sure they are ready before they can begin, we make it almost certain that they will be permanently out of the habit of taking the elemental risks of life and have lost much of the self-reliance from which pioneer fathers literally hewed the structure of a new society. If we are to be pioneers again, in this altered world, we must bring young people to grips with life in its risk-taking years. Perhaps it is here that Russia, with its more robust naturalism, may outdistance us. It is sheer romance to expect youth by the millions to spend an artificially lengthened adolescence in an ivory tower and not turn serious attention to career preparation until the A.B. has been won, presumably at the age of twenty-two.

We sin against youth when we undertake to separate culture from skill of hand and make it a mere matter of erudition. The result is all too often a feeble dilettantism or a sterile scholasticism. You get too many people who know the patter of the art world or the music world or the theater, but who do not paint pictures or compose music or produce plays. You get too many arid monographs on the historical or critical minutiae of literature and too little writing of poetry or drama or biography or fiction. Too often this is miscalled *culture,* a self-righteous word which well-rounded people are inclined to avoid. In the great creative epochs of the past there was no such separation of culture from work.

Consider, for example, the incomparable flowering of art in the relatively minor city of Florence, which at the climax of the Renaissance seems to have had a population about equal to that of our Ohio city of Canton. Yet what a galaxy of Florentine names clusters around this year of 1500—the Lippis, the della Robbias, Raphael, Botticelli, Ghirlandaio, del Sarto, Donatello, Ghiberti, Verrocchio, Brunelleschi, Perugino, and not forgetting Michelangelo and da Vinci, who were too great for even Florence to contain. Look up their stories and you will find that every lad of them went to work in his teens as an apprentice in the shop of a craftsman or the studio of an artist. They were creators first and became scholars only because they were creators. The illusion that the graduate school with its microscopic scholarship is the matrix of culture is something we borrowed from the Germans and are finding it hard to forget.

No one questions that we need an elite of scholarship, morals, and culture as much as religion needs a professional ministry and politics its nucleus of career men and women, but to asert that the selection and formation of any such elite caste should be the main preoccupation of higher education for the millions seems strangely lacking in proportion and perspective. For most of our youth moral values are not something to be learned in the abstract, or for philosophers in ivory towers to spin out like spider webs in filaments of pure thought. Our youth hammer out their moral values in the crude forge of human experience. That is not to say that eternal principles of right, truth, justice, and compassion are not embodied in the very core of the universe, or that they are not recorded in the hallowed literature of the ages, or that they are not incarnated in sublime or even divine personalities. The gold is there, all right, but it gets hammered into the coin of human relations the hard way by trial and error.

Indoctrination has its place, but it does not solve many moral problems in the concrete. We all know that love is good and hate is evil, but our problem is how to love our enemies when our sense of decency and fair play is revolted. We all know that war is an abomination and peace a boon above price, but our problem is how to preserve for ourselves and guarantee to our grandchildren a decent way of living with gangsters loose in the world. We all know that greed is hateful and the golden rule a moral imperative, but our problem is to get enough for ourselves to live up to our inborn capacities while making it possible for all other men to do the same. We all know that the moral crisis of our times is to make the material means of living the servants of great ends and not the masters of mankind, or possibly a Frankenstein monster. The author remembers hearing the venerable Master of Oriel College in between-wars England lamenting that "it was no longer possible for a few men to be idle in order that many men may be good." Of course we need philosophers and critics and seers to contemplate and examine and feel these issues profoundly, but for one of these we need a thousand men and women of good will and intelligence who will forge moral values out of the very heat of the struggle to raise food, produce goods, sell merchandise, build houses, cure the sick, raise families, run homes, teach school, and make communities clean and decent.

Scholarship which isolates itself from life is all too likely to lose its way in moral detachment. The futility of the learned world in the universal crisis of the last decade, the apparent result of carrying over into the humanistic realm the moral neutrality of the physical sciences, has been all too sadly apparent. If we must choose between the healthy realism of men at daily grips with the world of work and the bloodless, critical cynicism of the intellectuals of the 1930's in the crisis of moral nihilism, the choice seems clear. The standards of moral integrity set and upheld in the professions must be counted among the most effective moral anchors of our times.

As a final item in this confession of educational sins against youth, give thought for a moment to widespread illusion that freedom is a natural birthright. The American people are not too happy about what the war disclosed concerning the rearing and education of our youth. Granting the military standards were set high, it was a shock to find a third of our young men unfit physically, mentally, or emotionally for the armed forces and that war service had so little pull on young women apart from glamorized uniforms and romantic jobs. For all our boasting, freedom has obviously not worked too well. This clearly is a major factor in the demand of our armed forces for a system of universal military training, as yet unsupported by any evidence of its military effectiveness.

However we do it, education must have goals of discipline as well as freedom. Seemingly different, the two are really one. One of the most suggestive verses in the Bible is this: "If a man compel thee to go one mile go with him twain." This text is obviously a counsel of perfection, foolish if taken literally, but emphasizing a profound truth by its apparent denial of common sense. What it means is that many of life's experiences begin with a mile of compulsion, but that its true freedom and durable rewards are to be won only in the mile of voluntary striving which lies beyond. In the first mile men must work to live; in the second they work to maintain their sense of dignity and worth. In the first mile they seek tangible rewards; in the second they strive for enduring satisfactions. In the first mile men seek pleasure; in the second, they discover happiness. The first mile is the mile of discipline; the second is the mile of freedom.

Real freedom is not a birthright, it is something you have to win the hard way. Perhaps you can sit down at the piano and pick out the classic *Chopsticks* by hit and skip, but you can't sit down like Artur Rubenstein with the Philharmonic and thunder out the *Emperor Concerto*. Even in my sixties I might step onto the pitcher's mound and get the ball somewhere near waist high and perhaps over the plate, but I couldn't put the fire on it like Bob Feller and strike out the best batters in the league. The simple truth is that Artur Rubenstein and Bob Feller have a freedom that you and I do not possess. Born that way? Each has his natural gift, but each has had to earn his freedom by a relentless discipline of study and practice. He has to work to keep it, too. The great Paderewski, whose genius at the piano used to move thousands to ecstasies, once said, "If I neglect my practice for one week, I know it; if I neglect it for two weeks, my audience knows it."

No man's education is even well begun until he can do some thing extremely well. It does not matter so much what—type a letter, bake a pie, weld a seam, paint a house, do a portrait, beat a drum, compose a symphony, operate a radar, or design a Boulder Dam. What counts is the self-mastery that enables a man to look the world in the eye with a steady self-assurance.

The adequacy of any educational plan or system must be weighed in the scale of citizenship, no less than that of personal self-mastery, of career fitness, of cultural orientation, and of social and group morality. Engineers and scientists have had their share in the universal searching of educational consciences over our failure as a people before Pearl Harbor to discern the course of world affairs, to appraise aright the issues implicit in totalitarianism, to foresee the impending collapse of political and economic colonialism, and to get the problems of race and color into true perspective. They share the common concern of the hour to find the middle path of wisdom in our domestic economy between the extremes of individualism and parasitism, and are acutely conscious of the new issues arising out of long-range aerial missiles in combination with atomic and bacterial weapons of unimaginable potency.

As all reasonable men recognize, these shortcomings have been universal. The products of our most liberal disciplines have been no more proof against them than those of our most technical disciplines, nor are the measures taken or proposed by our technologists for world security and cooperation overshadowed by any offered by the purest of our humanistic thinkers. At the moment, dearth of topgrade civilian talent in government, particularly in the realm of international relations for which we naturally look to the liberal arm of education, has made it necessary to turn to military leaders whose fundamental training has been highly functional if not severely technical. The score on these counts is certainly not less than even, and not too creditable to either major wing of our educational system.

Citizenship for most men has its center much nearer home. Only half of it lies in the realm of politics and public agencies. Fully half lies in the domain of voluntary, self-constituted institutions—the chambers of commerce, citizens' leagues, community funds, welfare federations, community foundations, labor federations, social settlements, hospitals, museums, churches, symphony orchestras, community theaters, the Y's, the boy and girl scouts, the parent-teachers associations and the like, with which our civic life abounds. The role of the technologist in party politics is likely to be a secondary one and his role in public agencies is likely to be largely technical or administrative. His citizenship apart from election-day duties, will naturally find its most active expression in the voluntary institutions of community life. Here the standard to be met cannot possibly be less than full participation on a par with any other educated and professional group.

A similar standard applies to the engineer's individual participation in cultural life. His is a sustaining rather than a creating role. No one expects the engineer to write the books, compose the symphonies, create the dramas, paint the pictures, or formulate the philosophies in which an emerging American culture will find its symbolic expression, nor can we expect him to take a major part in shaping public standards of appreciation and criticism. It is extremely important, of course, that these things should be done, but it needs only a small elite among the educated population to do them. If engineers are counted in full proportions, when compared with any other educated groups, among those who read sound books, see good plays performed, attend the best musical events, frequent art exhibitions, give ear and voice to the best ideas being discussed, and pursue artistic hobbies—and to a surprising degree they are—the hackneyed and threadbare charge of being a Philistine will soon be forgotten.

The author has thought it worth while to write at length of these general attributes, as exemplified in the integral plan of education pursued by engineers, because he believes that they, rather than the traditional forms of the college of arts, form a general pattern for the greatly expanded system of higher education in America now in prospect. With over two million of our young people already in college and an increase to three million or more within a decade being confidently predicted, growth both in the size and number of our higher institutions seems clearly inevitable. What direction shall it take? Today we have about 22.5 percent of all our young people in college and if predictions come true we shall have 35 percent within a decade. In our present economy only about one actively employed person in sixteen is engaged in what the census classifies as a profession. An annual recruitment of between 100,000 and 125,000 would be ample to sustain our present professional numbers and a very modest addition will supply all needed gains. Where are the rest to go? Obviously into the general activities of business, industry, agriculture, and home-making and into various semiprofessional service occupations now multiplying on every hand.

The historic aims and patterns of the arts colleges still have their place in this emerging picture. The intellectual and cultural world will still need a professional and amateur elite; there will still be young people needing a longer period of exploratory education to bring their career interests to a focus; there will still be the stratified plan of training for certain professions; there will still be the families of comfortable means who crave for their young people a chance to finish off adolescence in an enriched and not too strenuous institutional life; but it is hard to figure these aims as a widely prevailing norm of higher education.

Against these traditional patterns, let us set up for comparison a type of education which has the following characteristics:

1. It is functionally related to a fairly broad area of economic activity.

2. It is integral in structure, with continuous bands of general humanistic studies, foundation studies, and more highly functional or technical studies running lengthwise throughout the curriculum.

3. It is of individually adjustable length, running through the entire range of undergraduate and post-graduate study.

4. It provides for progressively increasing specialization, beginning with little or none and dividing by successive steps into branches which cover broad area occupations (e.g., mechanical engineering), then specific professions or occupations (e.g., automotive engineering), then advanced specialties within such occupations (e.g., jet motor propulsion).

5. It shares the ethical standards and intellectual traditions of a great professional body.

6. It is highly motivated throughout, is strong in disciplinary features, calls for considerable intensity of applicaton, and affords sufficent scope for both individual discipleship and independent effort.

There need be no pretense that all the general attributes discussed above or all the more specific characteristics just enumerated are fully exemplified in all engineering curricula in all institutions. The range from the best to the worst is very wide. It can be said, however, that the ideal so expressed is being increasingly realized, especially in the interrelation of humanistic, scientific, and technical studies. A great impetus was given by two notable reports of the Society for the Promotion of Engineering Education (now the American Society for Engineering Education), one entitled "The Aims and Scope of Engineering Curricula" which appeared in 1940 and the second entitled "Engineering Education after the War" which was published in 1944.

These reports strongly advocated a broadening of the base of engineering education, with roots extended more deeply into the social sciences and humanities as well as into the physical sciences in order to sustain a rounded educational growth which will continue into professional life. To this end the development of the curriculum in parallel *scientific-technological* and *humanistic-social* stem was advocated, with each stem organized in an articulated sequence of subject matter and disciplines to lead to definite educational objectives. It was proposed that the scientific-technological studies should be directed toward:

1. Mastery of the fundamental scientific principles and a command of the basic knowledge underlying the branch of engineering the student is pursuing. This implies: (*a*) grasp of the meaning of physical and mathematical laws, and knowledge of how they were evolved and of the limitations of their use; (*b*) knowledge of materials, machines and structures.

2. Thorough understanding of the engineering method and elementary competence in its application. This requires: (*a*) comprehension of the interacting elements in situations which are to be analyzed; (*b*) ability to think straight in the application of fundamental principles to new problems; (*c*) reasonable skill in making approximations, and in choosing the type of approach in the light of the accuracy required and the time available for the solution—in sum, a foundation for engineering judgment; (*d*) resourcefulness and originality in devising means to an end; (*e*) understanding of the element of cost in engineering and the ability to deal with this factor just as competently as with technological factors.

3. Ability to select the significant results of an engineering study and to present them clearly and concisely by verbal and graphic means.

4. Stimulation of a continuing interest in further professional development.

It was further proposed that the sequence of humanistic-social studies should direct toward:

1. Understanding of the evolution of the social organization within which we live and of the influence of science and engineering on its development.

2. Ability to recognize and to make a critical analysis of a problem involving social and economic elements, to arrive at an intelligent opinion about it, and to read with discrimination and purpose toward these ends.

3. Ability to organize thoughts logically and to express them lucidly and convincingly in oral and written English.

4. Acquaintance with some of the great masterpieces of literature and an understanding of their setting in and influence upon civilization.

5. The development of moral, ethical, and social concepts essential to a satisfying personal philosophy, to a career consistent with the public welfare, and to a sound professional attitude.

6. Attainment of an interest and pleasure in these pursuits and thus of an inspiration to continued study.

Like all worthy educational goals, these statements substantially overtop present levels of attainment. However, progress toward their attainment has been steady and consistent. Implicit in the entire program is the idea that undergraduate training is essentially of a foundation character—what industry calls a blanking-out operation—and that the major goals of specific professional training lie chiefly in the years beyond. While designedly functional, the program outlined above is in no sense a narrow technical training. What it aims to do is to give a sound command of the basic knowledge and method which have led to extraordinary progress in one of the major sectors of human endeavor, in a setting of social significance and ethical responsibility. It would be a relatively simple operation to delete all specific references to engineering and to matters peculiar to it, and to substitute terms relating to other distinctive social functions.

(*Continued on page 438*)

RECENT CHANGES IN THE CANADIAN PATENT SYSTEM

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The author discusses changes in Patent Office procedure and recent legislation amending the Patent Act. He contrasts the Canadian and United States Patent Office systems and indicates how the new procedures will improve the usefulness of the Canadian Patent Office to engineers.

The new legislation introduces a classificaton of secret patents and the paper indicates the procedures to be adopted for issuance of patents of this type.

Three important developments have recently appeared in the Canadian patent system, which will streamline patent office practice and will increase the usefulness of our patent system to the engineering profession and others in scientific pursuits.

One recent change is a decision by the Patent Office to print Canadian patents and make them available for public distribution. Authority to print patents was in existence under The Patent Act, 1935, but previously such authority was not exercised. It is estimated that patents in printed form will cost twenty-five cents each.

The other two developments are legislative in character. One of these is the enacting by the Dominion Parliament of The Patent Act Amendment Act, 1947, which deals realistically with inventions relating to atomic energy and others important to national defence. The 1947 act provides curative treatment for patent applications prejudiced by World War II, and makes a number of technical changes in patent procedure which need not be discussed here.

Also legislative in character is the revision of the Patent Office Rules, which is currently taking place. The Rules are made pursuant to the Patent Act and govern the prosecution of applications for patents and the general administration of the Patent Office. The revision was made necessary partly by the passing of the 1947 act referred to above, and also because of a number of ambiguous portions of the existing Rules, and the presence in the Rules of several burdensome and outmoded requirements.

From the standpoint of the engineer, the introduction of printing is probably the most significant change.

The ready availability at a reasonable price of printed copies of patents in other countries, such as the United States and Britain, has made it possible for engineering and technical departments of companies, and other persons and bodies interested in scientific development to keep closely in touch with the trend in invention. Printed patents, along with current engineering literature and the physical and chemical abstracts, make it possible to follow technological developments in any given field or fields, and to integrate a complete picture of the advance of pure and applied science.

All that is done in Canada at present in respect to the printing of patents is a weekly publication—The Canadian Patent Office Record—which sets out for each patent issued during the current week the title of the invention, the name of the inventor, the assignee (if any), a small diagram (if the invention is of a character capable of being illustrated by drawings) and one or two claims. Unfortunately no part of the specification is printed in the " Record ". It is the specification which contains the detailed technical disclosure which is, of course, the part of greatest interest to engineers and research workers.

In Canada, at present, the specification of a patent can only be inspected by the public by examining the copy on file at the Patent Office, or a photostatic or stenographic copy made therefrom.

Ordering a photostatic or stenographic copy of a patent for inspection is not only expensive but it is also time-consuming. In spite of the fact that the Canadian Patent Office is staffed by able personnel, it is not physically possible to supply copies of patents in less than two or three days from the time the request is received. The cost of such copies is at least four dollars each, and is occasionally as high as ten dollars, depending on the number of pages and the number of drawings.

In the United States, for example, by way of contrast, where the usefulness of the patent system to the engineering profession has been amply demonstrated, patents are printed, as stated above, and have been for many years. There is also issued a weekly digest of patents, similar to ours, known as the United States Patent Office Gazette. This serves as an index to enable one to select the patents in which one is interested, and a request to the Patent Office will bring copies of any patents at a cost of twenty-five cents each.

The final decision to print in leaflet form, Canadian Patents for public distribution at a nominal charge, is definitely of great value to all of those desirous of building up at reasonable cost a Patent Art section. It is anticipated that printed copies will be available late this year.

There is included in the Patent Act Amendment Act, 1947, a general increase of Patent Office fees. It has been stated that the purpose of this increase is to defray the cost of printing.

The recent Dominion legislation, The Patent Act Amendment Act, 1947, introduces a new concept into Canadian law—the *secret patent*. It is provided that where an invention is of such a character that to make it public would be undesirable for the safety of the state, a patent may issue in complete secrecy, and may remain secret even after the patent expires, publication only being permitted when the secrecy ban is lifted by authority of the Minister of National Defence. Such inventions become, either actually or constructively, the property of the Crown, either by assignment by the inventor or by operation of law. The Crown is given the power to appropriate all rights arising under any patent application which discloses an invention deemed to be vital for national defence, without the consent of the inventor. The inventor may voluntarily assign such an invention to the Minister of National Defence, but even if he does not it may be appropriated by order-in-council. Inventions relating to national defence made by servants, officers or employees of the Crown or of Crown corporations acting in the scope of their duties must be assigned to the Crown, if required.

Lest it might seem that the appropriation of an invention without the inventor's consent is an arbitrary procedure, it should be said that provision is made for giving compensation to the inventor except where he is a servant, officer or employee of the Crown who has made an invention of the kind referred to in the scope of his duties, and must therefore be presumed to have been employed to make such inventions.

Where an inventor is entitled to compensation, if he is not satisfied with an amount which may be offered on behalf of the Crown he may have the amount determined at a hearing before the Commissioner of Patents. The decision of the Commissioner resulting from such a hearing is subject to appeal to the Exchequer Court of Canada, and in order to insure that the secrecy imposed on the invention is not interfered with provision is made for holding of such Exchequer Court proceedings *in camera*.

Whether the inventor voluntarily assigns his invention to the Crown, or it is apppropriated as provided by the new legislation, secrecy is enforced both before and after the issuance of a patent and until waived by the Minister of National Defence. A disclosure of the invention is made to the Patent Office, but the public does not share the disclosure when the patent issues, or at any other time, except by the authority of the Minister of National Defence.

Official secrecy is imposed strictly on inventions to which the new act applies at all stages until waived as aforesaid, and any unauthorized disclosure of confidential information in relation thereto is a serious offense under the Official Secrets Act. It is hardly necessary to state that members of the engineering profession should use extreme caution in dealing with projects arising under such secret patents, and ensure that no unauthorized disclosure of information is countenanced.

The Patent Act Amendment Act, 1947, also deals with inventions in the field of atomic energy, a matter of wide concern quite apart from the patents problems it raises. The Atomic Energy Control Board had already been set up when the above legislation was passed, and the new enactment merely brings the Patent Office into line with the policy of the Government whereby the Atomic Energy Control Board is, under Parliament, the supreme authority in the field of nucleonics.

The new legislation provides that the Patent Office will do its part in carrying out Canada's agreements with the other nations who share the atomic techniques, by keeping secret any patent applications where this is requested by the Atomic Energy Control Board, and by informing the Board of any patent applications in the field of nucleonics.

Where an application is made for a patent in the normal way in respect of an atomic invention, before any section is taken on the application it must, by the terms of the new legislation, be submitted to the Atomic Energy Control Board.

The dislocations associated with the recent war caused serious prejudice to the patent protection of many inventions. In many cases, for example, it was not possible to file certain documents within the prescribed time owing to delays occasioned by reason of the hostilities.

In the United States, legislation has been passed directed toward relieving such hardship on inventors and others, known as The Boykin Act. The recent Canadian legislation proceeds along lines similar to this United States act and provides that where a right of performing some function under the Patent Act had not expired at the beginning of hostilities, September 2, 1939, the right is extended to September 30, 1947. Such an extension is also made in respect of the performance of functions in relation to patent applications filed since the beginning of hostilities. These rights may be exercised by or on behalf of Canadian citizens and nationals of countries which extend substantially reciprocal privileges to Canadians. The Boykin Act of the United States referred to above is an example of the kind of reciprocal legislation contemplated.

In order to prevent the period of patent protection granted pursuant to these extension provisions from being unduly long, it is provided that where advantage is taken of the extension provisions, the life of a patent which subsequently issued shall be limited to twenty-two years from the date of the original application, or seventeen years from the issue date, whichever is the shorter.

In order to protect the rights of third parties, no action of infringement can be brought with regard to a patent in respect of which there was an extension of time as described above, where the act of alleged infringement took place before the 1st of March, 1947.

As mentioned previously, the Rules according to which our patent system is administered are in the process of revision, but since these are not yet made public, and in any case are largely procedural rather than substantive in character, no useful purpose would be served by speculating on their probable content.

The above is merely an outline and should not be considered an exhaustive treatment of the recent changes in the Canadian patent system. It is intended only to call the attention of *Journal* readers to the fact that our patent system, like engineering, is not static, but is the living exponent of new techniques and new ways, and will soon be in a better position to serve the engineering profession.

ELEMENTARY SHEAR FLOW ANALYSIS

(Continued from page 430)

In all the above cases no account has been taken of buckling effect in web panels under design loads. The determination of effective sections with modified neutral axes is beyond the scope of this article. The reader can however easily adapt the basic theory given in these problems to the more advanced cases, some of which are analyzed in the following references;

Airplane Structures............Niles and Newell
Airplane Structural Analysis and Design
Sechler and Dunn
Analysis and Design of Airplane Structures...Bruhn
Basic Structures........................Shanley
Journal of the Aeronautical Sciences..............
various articles

AXOMETRIC PROJECTION

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During the war years, when quickly projected drawings and sketches were an urgent necessity, it was recognized that one-view projections could often provide easily visualized representations of a wide variety of engineering objects. Because of the time factor, isometric projection was the type of one-view projection usually employed. Isometric projection undoubtedly has advantages in simplicity of construction and application, but the equal scales and equal orientation of the projected axes produce a projection which places equal emphasis on all three dimensions: length, breadth and depth. Frequently a projection is required to show more of the plane containing the length (L) and depth (D) axes (i.e. the front surface), and of the plane containing the breadth (B) and D axes (side surface), and less of the plane containing the L and B axes (top surface). This choice of direction of view is accomplished by axometric projection—a type of projection in which the three mutually perpendicular axes are arranged so that, in general, each makes an angle with the axometric projection plane which differs from those of the other two.

Since the "scale" of the projection of a line, (that is, the ratio of the projected length to the true length), is equal to the cosine of the angle which the line makes with the projection plane, it follows that the scales of the projections of all three sets of lines parallel respectively to the L, B and D axes will, in general, differ from each other.

The processes of descriptive geometry, which are those usually employed in setting-up the projections of the three axes, are not difficult but require a certain amount of time and involve a number of geometric operations, the accuracy of which influences the accuracy of the resulting projection. It is believed that the methods here presented reduce the amount of time and the number of steps to a minimum.

In commencing an axometric projection a choice must be made between two features which are interdependent. Either (1) the angular arrangement of the projected axes may be chosen (within certain limits) or (2) fractional scale values (within limits) for two of the axes may be chosen. The first governs the relative extent of the projected plane surfaces of the object (e.g. more top surface, less front surface, etc.) and, when chosen, regulates the scale values for all three axes. In the second, the scale values are chosen and the angular arrangement of the projected axes must conform to this choice.

The first is probably more popular among architects because it permits of an initial choice of view-point. However, this feature, with some practice, also may be achieved in the second—that is, scale values may be chosen which will result in a desired direction of view.

(1) Angular Arrangement of the Projected Axes.

Referring to Fig. 1 (i), *ol*, *ob* and *od* are the chosen directions of the projections of the L, B and D axes respectively. These projections will be called L', B', and D'. The angle which D' produced makes with L' will be called ϕ_L and that with B' ϕ_B.

Any values of ϕ_L and ϕ_B may be chosen provided that each is greater than 0° and less than 90°, and that the sum of the two, $\phi_L + \phi_B$, is greater than 90°. In practice it will be found that each should lie between 15° and 75°. The greater $\phi_L + \phi_B$ is made the less will the projection show of the plane containing L and B (top surface).

Having chosen the angular arrangement of L', B' and D', the construction shown in Fig. 1 (ii) is as follows. A line *lb* is drawn at 90° to D', a line *ld* at 90° to B' and, as a check, a line *bd* at 90° to L'. This triangular figure, *lbd*, may be made as large or as small as desired.

A semi-circle is drawn on *lb* as diameter; another on *ld* as diameter; a third semi-circle may be drawn on *bd* as diameter if required. D' is produced to meet the first semi-circle in *p*; B' is produced to meet the second in *q*. *lpb* is a rabattement of the right-angled triangle *LOB* and, similarly, *lqd* is a rabattement of the right-angled triangle *LOD*. Being rabattements, they may be utilized in the usual manner for all true measurements, angles, etc., of figures lying within their respective planes.

Full scale units are marked along *pl*, along *pb*, and along *qd*. When carried perpendicularly across *lb* for the first two and across *ld* for the third, to L', B' and D', the divisions on *ol*, *ob* and *od* will show the scales for the three axes respectively. It should be noted that the full scale units are all equal while the axometric scale units differ as between one projected axis and another. The full scale units may, themselves, represent any given dimension. For instance one full scale unit may represent 10 feet in which case the axometric units, at present marked "1" and "2", will then represent 10 feet and 20 feet. In this way scales for use along, or parallel to, each of the three axometric axes are constructed.

Figure 1 (iii) illustrates a simple object projected with the aid of the scales obtained at (ii). In passing, it may be noted that a circle lying in the plane of the L and B axes will project as an ellipse having a *full scale* major axis perpendicular to D'; similarly a circle lying in the plane of the L and D axes will have its major axis perpendicular to B'.

(2) Axometric Axes to Chosen Scale Values.

This type of axometric projection has, hitherto, required the somewhat lengthy constructions of descriptive geometry processes.

It has been mentioned that the ratio of the projected

TABLE I

Showing the percentage error involved in using certain simple fractional scale values for all three axes.

	Chosen Scale Values	Approximate Third Scale Value	True Third Scale Value	Error
1	4/5 and 3/4	9/10	0.893	+ 0.78%
2	4/5 and 7/10	15/16	0.933	+ 0.53%
3	5/6 and 7/10	9/10	0.903	— 0.33%
4	3/4 and 3/4	15/16	0.9355	+ 0.2%
5	3/4 and 15/16	3/4	0.7475	+ 0.33%
6	7/8 and 11/16	7/8	0.8725	+ 0.28%
7	7/8 and 7/8	11/16	0.6844	+ 0.46%
8	15/16 and 1/2	15/16	0.933	+ 0.47%
9	15/16 and 9/16	9/10	0.897	+ 0.33%
10	7/8 and 15/16	3/5	0.596	+ 0.67%
11	11/16 and 13/16	15/16	0.931	+ 0.7%
12	9/10 and 9/10	5/8	0.616	+ 1.43%
13	7/8 and 2/3	8/9	0.88875	Negligible
14	8/9 and 2/3	7/8	0.8749	Negligible
15	7/8 and 8/9	2/3	0.6665	Negligible
16	7/9 and 8/9	—	7/9	No Error
17	7/9 and 7/9	—	8/9	No Error

length to the true length constitutes the "scale". To distinguish this scale from a line along which equal units of measurement are marked, let us call the ratio a "scale value". This scale value, the cosine of the angle of inclination to the axometric projection plane, may be either a decimal fraction or a simple fraction such as ¾ or ⅞. The arbitrary choice (within limits) of the angle of inclination of two axes automatically fixes the angle of inclination of the third axis to the projection plane. While it is possible, therefore, to choose scale values for two of the axes, (as for example, ⅞ for L axis and ¾ for the D axis,) the dependent scale value for the third axis (B in this case) will not be, in general, a simple fraction. In the choice just mentioned, the scale value for the B axis is 0.8196, which for all draughting purposes may be taken as 0.82.

There are, however, certain combinations of two simple fractions for the two chosen scale values which have for the third, or dependent, axis a scale value very closely approximating a simple fraction. Some of these combinations are tabulated in Table I.

In what appears to be a singular, though not particularly convenient, case there are three simple fractions which satisfy exactly the requirements for simultaneous axometric scale values—namely 7/9, 8/9, 7/9 (taken in any order when applied to L', B' and D').

In the following, the fractional scale values will be called S_L, S_B and S_D; so that

$$S_L = \frac{L'}{L},\ S_B = \frac{B'}{B},\ S_D = \frac{D'}{D}.$$

ϕ_L and ϕ_B, as already defined, are the angles which D' produced makes with L' and B' respectively.

Use of Charts I and II for the Set-Up of Axes.

It may be proved that*

$$(S_L)^2 = (S_B)^2 = (S_D)^2 = 2 \quad \ldots\ldots\ldots\ldots\ (1)$$

$$Sin\ \phi_L = \frac{\sqrt{1 - (S_B)^2}}{S_L \times S_D} \quad \ldots\ldots\ldots\ldots\ (2)$$

$$Sin\ \phi_B = \frac{\sqrt{1 - (S_L)^2}}{S_B \times S_D} \quad \ldots\ldots\ldots\ldots\ (3)$$

Charts I and II provide quick solutions for these equations.

Example.

Let two scale values be chosen for *any* two of the three axes, such as $S_L = 0.9$ and $S_D = 0.8$

On Chart I draw a straight line from 0.9 on Chosen Scale Value "1" to 0.8 on Chosen Scale Value "2"; read the scale value for the third axis (S_B in this case) from the central Dependent Scale Value = somewhat greater than 0.74, say 0.741, (by solution of equation 1 $S_B = 0.7416$).

Chart II.

The product $S_L \times S_D = 0.9 \times 0.8 = 0.72$.

An arc of radius 0.72 is drawn to intersect a vertical line from $S_B = 0.741$. This gives ϕ_L.

*Detailed proof of these relations will be furnished by the author on request.

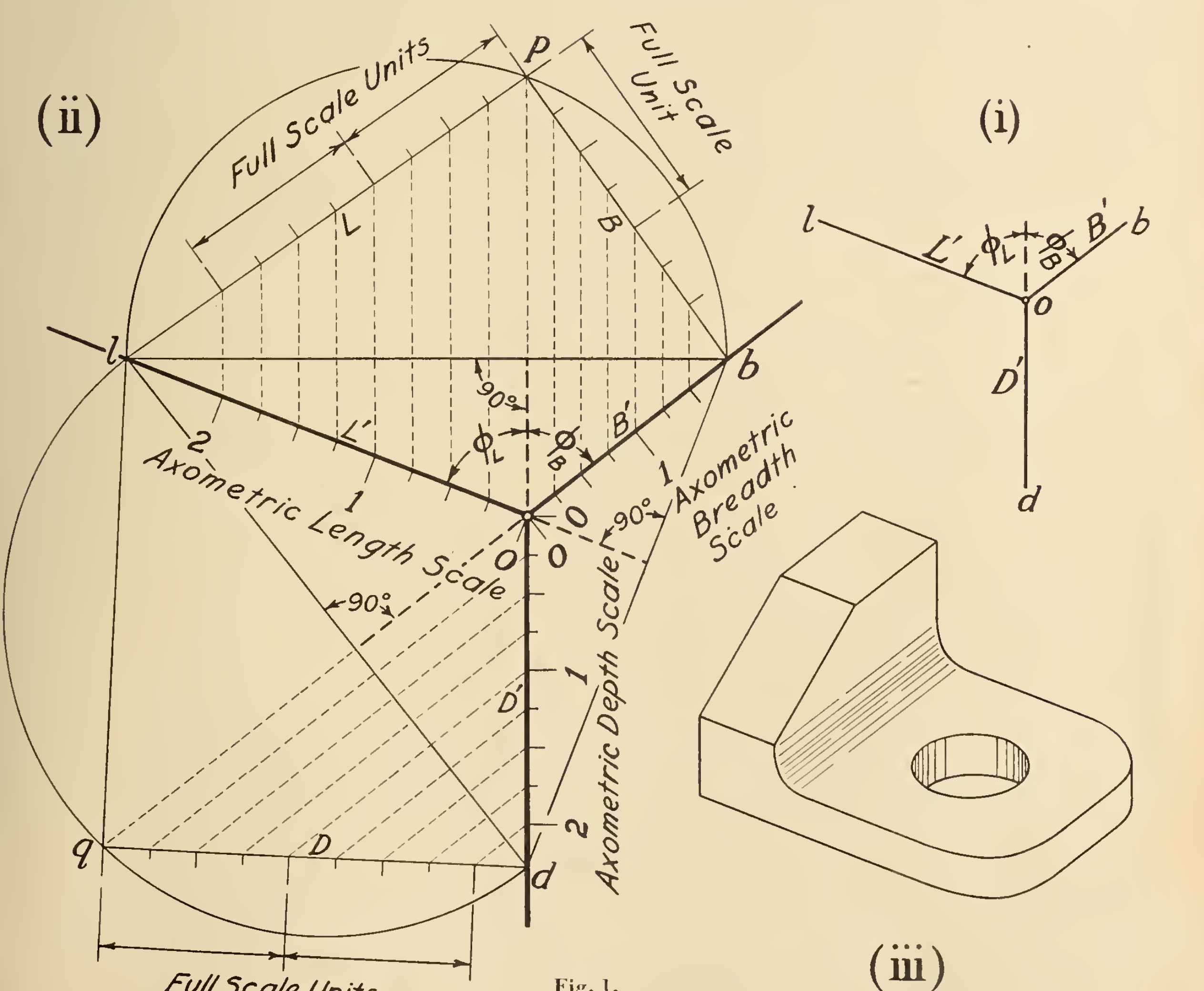

Fig. 1.

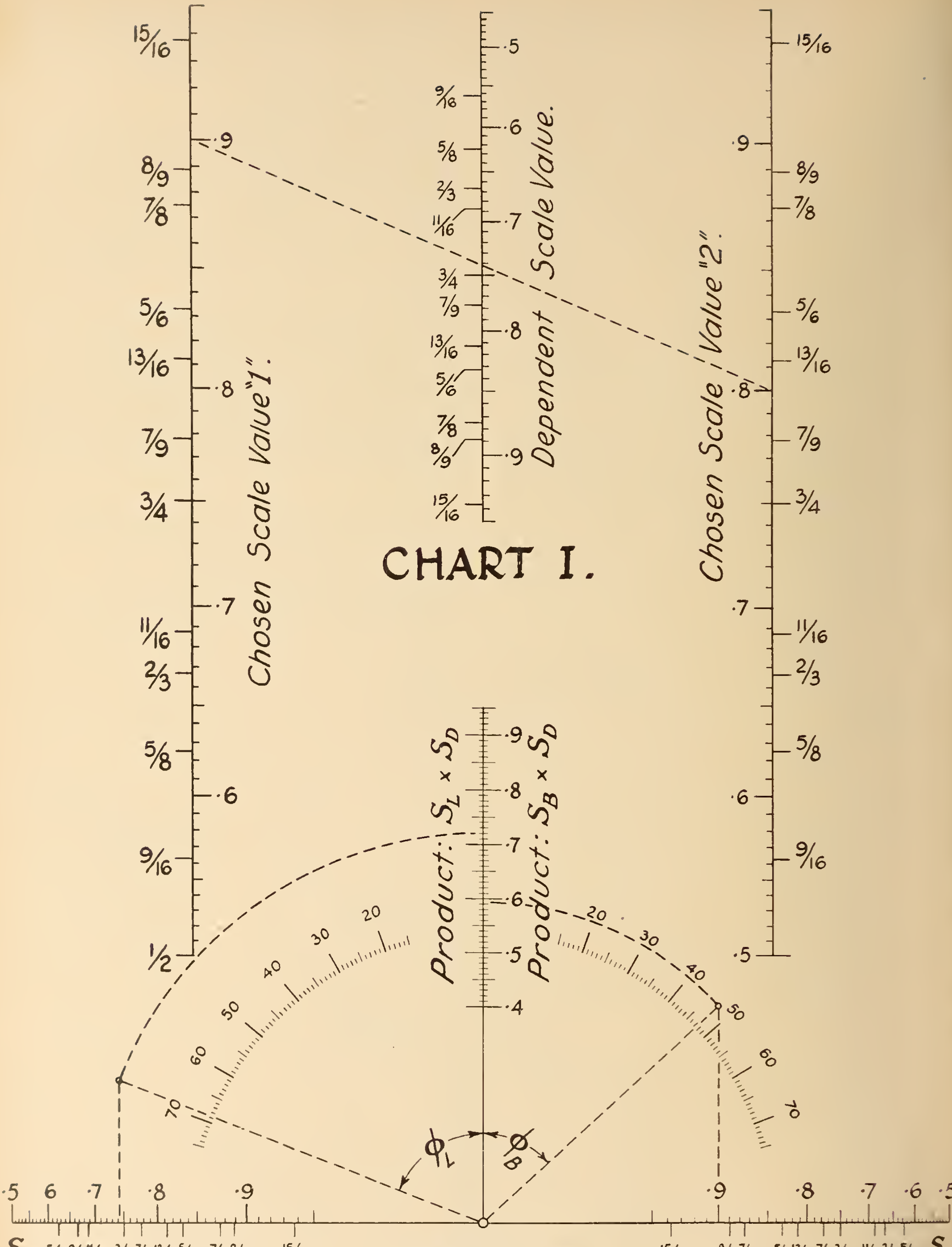

CHART I.

CHART II.

The product $S_B \times S_D = 0.741 \times 0.8 = 0.593$.

An arc of radius 0.593 is drawn to intersect a vertical line from $S_L = 0.9$. This gives ϕ_B.

Having determined the three scale values and the angular arrangement of the projected axes the axometric projection may be quickly constructed. If the number of dimensions to be set out is considerable it will expedite the work if 0.9, 0.8 and 0.74 scales are constructed for immediate use in projecting dimensions respectively parallel to the three axes.

CENTENARY CELEBRATIONS OF THE INSTITUTION OF MECHANICAL ENGINEERS

LONDON, JUNE 8th-13th, 1947

A report by Professor E. A. Allcut, M.E.I.C., who represented The Engineering Institute of Canada and the University of Toronto

The Institution of Mechanical Engineers is the oldest Mechanical Engineering Society in the world, having been founded at Birmingham in January, 1847, with George Stephenson, of locomotive fame, as its first president. A very fine collection of Stephenson relics was exhibited at the Institution building during the celebrations.

During that week I had the honour to represent both The Engineering Institute of Canada and the University of Toronto, and, as representative of the senior Dominion, I was given a prominent place on all official occasions.

The ceremonies began on Sunday, June 8th, with a Thanksgiving Service in Westminster Abbey, where the principal delegates were given seats in the stalls, immediately behind the choir. This ceremony was a very impressive one, and the sermon was preached by the Dean of Canterbury (himself a qualified engineer!).

The opening session took place on Monday, June 9th, and was preceded by an inaugural luncheon at the Dorchester Hotel, where I was entrusted with the honour and responsibility of replying to the toast to "The Delegates" which was proposed by the President, Lord Dudley Gordon, D.S.O. A copy of this reply, the opening speech of the week, is appended to this report.

The official opening took place in the Great Hall of the Institution of Civil Engineers and the opening speech was made by the Lord President of the Council, The Rt. Hon. Herbert Morrison, M.P. About one thousand persons were present, the Great Hall being entirely filled.

In the evening there was a reception by the President at the Science Museum, South Kensington, when the Minister of Education, The Rt. Hon. George Tomlinson, M.P., opened an Exhibition of "A Century of Mechanical Engineering."

On the following days, the mornings were devoted to simultaneous technical sessions as follows:

Tuesday, June 10th

(1) Marine Power Plant
(2) Aircraft Power Plant
(3) Machine Tools, Gauging and Metrology, Industrial Administration.

Wednesday, June 11th

(1) Mechanical Plant for Power Stations
(2) Handling Machinery
(3) Air Conditioning; Heating and Ventilating; Refrigeration.

Thursday, June 12th

(1) Railway Power Plant: Steam, Diesel-electric, and Electric
(2) Education and Practical Training of Mechanical Engineers
(3) Mechanical Engineering in the Process Industries.

Friday, June 13th

(1) Road Motor Vehicles
(2) Applied Mechanics
(3) Hydraulic Machinery.

The papers in each session were well presented and there were large audiences at those meetings that I attended. The afternoons were occupied by visits to various works in the London area.

On Tuesday evening, June 10th, the Clayton Lecture on "The Possibilities of Nuclear Energy for Heat and Power Production" was given by Professor J. D. Cockcroft, and this was followed by a reception given by H. M. Government at Lancaster House, the guests being received by the Lord President of the Council.

On Wednesday evening, June 11th, there was a very interesting private ceremony when Lord Dudley Gordon was invested as an Honorary Member of the American Society of Mechanical Engineers with Professor Christie acting on behalf of the President of the Society. This was followed by the Parsons Memorial Lecture, given by Sir Claude Gibb, at which function a painting of Sir Charles Parsons was unveiled by the First Lord of the Admiralty, Rt. Hon. Viscount Hall, P.C.

The climax was a banquet at the Guildhall where a very distinguished company included five Cabinet Ministers and the Lord Mayor of London. The toast to the Institution of Mechanical Engineers was proposed by the Prime Minister himself.

Thus ended a memorable week!

E. A. Allcut, M.E.I.C.
Professor of Mechanical Engineering

August 6, 1947.

Reply by Professor E. A. Allcut, M.E.I.C. (Toronto), to the Toast to the Delegates at the Centenary Celebrations of the Institution of Mechanical Engineers, London, June 9, 1947.

Mr. President, my Lord and Gentlemen:

Like Reginald Bunthorne, "I am not fond of uttering platitudes in stained glass attitudes" and therefore you must forgive me if, in thanking you most sincerely (as I do), for your cordial reception of this toast, my remarks take a somewhat practical turn.

Engineering knows no boundaries; its applications are international and their consequences are universal; therefore artificial barriers must and will disappear eventually. The most serious difficulties are caused by differences of language, standards, and ideas. The language problem is likely to be with us for a considerable time, but some progress has been made with regard to the other two. Recently, differences between the American and British screw threads have been bridged satisfactorily but further improvements are desirable. Why, for instance, should "tons" and "gallons" mean different things in different countries?

Surely it is not impossible to arrive at common standards in these and other fundamental units of measurement. The common heritage, which we now celebrate, should be expressed in common terms.

Community of ideas may be arrived at by suitable education and here again, the English-speaking peoples might appropriately lead the way, as in their case, language barriers do not exist. This might be promoted by an increased degree of international collaboration between students and research workers and I suggest that an appropriate result of this happy occasion might be the establishment of a fund to enable engineering students to do post-graduate work in countries other than those in which they received their undergraduate training. Such a scheme would help materially to remove those prejudices which are potent causes of misunderstanding and disputes. "To know all is to forgive all", and personal contact in a man's own country and environment is the best approach to knowledge. This requires money, but the expenditure would be well worth while.

At this time, universities and other educational institutions are crowded with students and such a scheme as this would be impracticable on any large scale, but a start could be made and, when the present situation has passed, sufficient staff and facilities for the larger scheme will be available. For example, the University of Toronto, which I have the honour to represent, has upwards of 4,000 engineering undergraduates, and laboratories and teaching facilities are now being enlarged and improved for their instruction and accommodation. In a few years it is anticipated that the registration will probably be about 1,500, and in that event, there will certainly be greatly increased opportunities for graduate and research work. Undoubtedly, other institutions have similar programmes and will be able to offer comparable facilities. The quality of the work done, however, depends upon the calibre of the personnel, and particularly on that broadness of outlook that is promoted by personal association between thinking people in different countries. I submit that, in the interests of the engineering profession generally, this interchange of ideas and experiences is vitally necessary and the movement might well start here and now. Its implications, moreover, extend beyond the field of engineering, and in referring to these I speak only as a private citizen having no political affiliations or ambitions, born and educated in England, resident in Canada for twenty-five years, and with many associates in the United States. As a result of this experience I firmly believe that the peace of the world and the preservation of civilization depend on the maintenance of the integrity of the British Empire and all that it implies, and on its close association with the United States. This is not a mere piece of rhetoric, but a plain and sober statement of fact. The scheme that I suggest, if properly applied, can and will assist in promoting that mutual understanding and co-operation.

In expressing the thanks of the delegates here assembled, may I also extend felicitations to you, sir, and to the Institution over which you preside on its attaining the status of a hale and hearty centenarian. May the next hundred years be equally happy and prosperous—they could not be more so.

RADIANT HEATING AND COOLING APPLIED TO PREFABRICATED FLOORS AND CEILINGS

(*Continued from page 426*)

and working space for tradesmen. Partitions may be placed independently of the floor joists and bridging members. The depth of the girder beams and the weight on the building columns is reduced.

While radiant heating is comparatively new here, it is the author's belief that it is ideally suited to the climate and constructional conditions common in Canada. Because of slow progress today on construction, and because of inefficiency and the high cost of on-site-labour, prefabricated units are becoming more common in the construction of large buildings. The combination of prefabricated floor and ceiling units with radiant heating and cooling appears to provide cost and time saving advantages which should prove valuable in the construction of large buildings in the future.

SHALL HIGHER EDUCATION BE EXPANDED ON THE TECHNOLOGICAL PATTERN?

(*Continued from page 431*)

The architects of this plan had in view only the aims and scope of engineering education, yet their drafting may have been on broader lines than they knew. There is much in both the letter and the spirit of their pronouncement which is reminiscent of the goals visualized exactly one hundred years ago by B. Franklin Greene, who reorganized the historic Rensselaer School which Amos Eaton had established in Troy into the Rensselaer Polytechnic Institute, prototype of our engineering schools of today. Without doubt Greene was the first man in America to submit the problems of education for the scientific and technical professions to thorough investigation and analysis. In essential matters his conclusions remain valid today. What he visualized was "an educational discipline complete in itself, not narrowly vocational, but adapted to the complete realization of true educational culture." Prophetic words! In the author's opinion, to repeat an earlier statement, if the great expansion of higher education predicted for the next decade is actually realized, it seems likely that much more of it will follow the mode established in engineering, at least in its general plan and outline, than the older traditions of the liberal arts.

From Month to Month

News of the Institute and other Societies, Comments and Correspondence, Elections and Transfers

UNESCO

Recently a meeting was held in Toronto at the request of the Under-Secretary of State for External Affairs, to discuss matters relating to the work of UNESCO. The Institute was represented by Mr. Wills Maclachlan and the following paragraphs taken from his report will indicate the scope and importance of the work under discussion.

The meeting was held in the Lecture Room of Emmanuel College of the University of Toronto on Tuesday, July 29th and something over one hundred different organizations and governmental bodies were invited. Between fifty and sixty organizations were represented. Vincent Price, K.C., chairman of the National Executive Committee of the United Nations Association in Canada, acted as chairman. After the preliminary matters were explained by the Chairman, Mr. C. F. Fraser, recently a repesentative of UNESCO, explained the problem, taking as a particular example, the devastated areas of Burma. In this country, common schools were completely destroyed, high schools were destroyed and looted, colleges had their libraries looted and destroyed, and much scientific apparatus done away with. Public and reference libraries, museums and art galleries were looted and destroyed. Many of the teachers, professors, engineers and artists were killed. It was quite apparent that, to make even a start in education and cultural development, assistance would have to be forthcoming from donor nations.

These questions have been thoroughly canvassed by committees of UNESCO and at a conference in Paris last winter. The United States has started to raise a fund of some $25,000,000.00 and also are making plans to receive voluntary donations of books and scientific apparatus for use in these devastated countries. It was explained that the Government of Canada wished that what help Canada could give to this problem, be made by voluntary organizations, other than the $300,000.00 annual grant to the administration of UNESCO. Different government representatives spoke and emphasized this idea.

It was agreed that a temporary council of the cooperative organizations to deal with the problem in Canada, be composed of those representatives of organizations that were present at the meeting and that the organizations be written to and requested to appoint each a delegate and an alternate to the council. An executive committee of fifteen was elected to temporarily carry forward the work of organization and take what action was necessary. It is quite probable that a later meeting will be called early in September.

It was recommended that an appeal be made to the people of Canada to contribute to a fund to purchase supplies, the minimum objective to be $2,000,000.00. There is no doubt that the major organizations that will be requested to head up this appeal will be such organizations as the Canadian Red Cross, I.O.D.E., Y.M.C.A., etc. as these organizations are experienced in carrying out appeals for funds. The various teachers' organizations represented, have done much to meet the situation and are ready to carry forward any definite plan agreed upon.

It is proposed that The Engineering Institute of Canada can most effectively co-operate by making an appeal to its membership at a later date for books and equipment that would be needed in engineering colleges in the devastated areas. This would be most effective if carried out in co-operation with other organizations in Canada such as the Royal Society, scientific societies, and other engineering groups.

ENGINEERS AND SMOKE

A subject that is of interest to every community is smoke abatement, but unfortunately not every community does something about it. Recently attention of Headquarters has been called to a development in Windsor, Ontario. There the Chamber of Commerce has set up a committee to study the problem and out of five members has chosen three engineers.

All three are members of the Institute and all three have been chairman of the branch. A. E. West was chairman in 1929 and H. L. Johnston in 1942. The third member, A. D. Harris, is in that office now. A cartoon published recently in the Windsor Star shows the five man committee sitting around a board table almost undistinguishable in a cloud of smoke of their own making, with a resolution before them saying, " Resolved that Windsor's smoke nuisance be abolished ". Everyone will wish them success in their endeavour.

A few weeks ago, the City of Detroit, just across the river from Windsor, set up new regulations for smoke control. On the committee established by the city to work out the solution were several engineers. It is encouraging to see this recognition of the special abilities of engineers to help in the solution of municipal problems.

WORLD POWER CONFERENCE

The Canadian Committee of this organization met in Ottawa on Wednesday, August the 6th. The Conference has been dormant throughout the war but its activities were revived by the International Executive Council which met in London in 1945 and in Paris in 1946. A third meeting is arranged for September the 3rd at The Hague.

The Canadian Committee represents several groups of interested organizations and its present membership is made up as follows: Chairman, Charles Camsell, M.E.I.C., lately Deputy Minister, Department of Mines and Resources; Secretary, Norman Marr, M.E.I.C., Assistant Controller, Dominion Water and Power Bureau; J. B. Challies, M.E.I.C., Vice-President and Executive Engineer, Shawinigan Water and Power Company; G. Gordon Gale, M.E.I.C., President, Gatineau Power Company; T. H. Hogg, M.E.I.C., Consulting Engineer, H.E.P.C. of Ontario; C. J. Mackenzie, M.E.I.C., President, National Research Council; Herbert Marshall, Dominion Statistician; Victor M. Meek, M.E.I.C., Controller, Dominion Water & Power Bureau; John Murphy, M.E.I.C.; A. B. Normandin, M.E.I.C., Vice-President, Provincial Electricity Board of Quebec, and Austin Wright, M.E.I.C., General Secretary of The Engineering Institute of Canada.

A divisional conference is called for this year at The Hague on September 2nd to the 9th, dealing with Fuel Economy. The Canadian Committee has supplied two papers for this programme: *a*—Canadian Coals, Their Characteristics and Utilization by R. E. Gilmore and E. J. Burrough, and *b*—The Bituminous Sands of Alberta as a Source of Liquid Fuels by T. E. Warren and K. W. Bowles.

The next meeting of the whole Conference is set for 1950, probably in London or Paris. Previous meetings have been held as follows:

1938—Washington
1930—Berlin
1925—London

EXTENSION OF ENGINEERING COURSES AT CARLETON COLLEGE, OTTAWA

Carleton College has announced arrangements with McGill University whereby it will extend its present first year general engineering course to include a second year. Recommended students completing the two years of study at Carleton will be admitted to third year civil, electrical or mechanical engineering courses at McGill.

The new second year course will include economics, calculus, spherical trigonometry, materials of engineering, mechanical drawing, applied mechanics, physics, geology, surveying, engineering problems, chemistry, mechanics of machines and heat engines. All engineering studies will be under the supervision of Prof. L. N. Richardson and will begin September 22nd for first year and September 29th for second year.

N.R.C. ASKS FOR COMMENT ON METER APPROVALS PROGRAMME

At the request of the Standards Division of the Department of Trade and Commerce, the National Research Council will review the serviceability and type approvals of all types of electrical meters at present approved for use under the provisions of the Electricity Inspection Act.

The Council will appreciate any suggestions from interested persons or organizations.

STANDARDIZED CONCRETE REINFORCING DETAILS

Following an intensive survey and consultation with engineers in the industry, the Steel Company of Canada has announced a new "Standard Bending Details Chart" which they hope will gain wide acceptance in the construction field. The chart is at present under consideration by the Canadian Standards Association for possible inclusion with present C.S.A. standards G-30 and 31 covering reinforcing bars for concrete.

The company had noted the wide variety of detailing methods for reinforcing steel in use in the industry and believed that a measure of standardization should be possible. Such standardization should be of assistance in avoiding errors in ordering reinforcing and might speed up deliveries. The details have been issued as a large wall chart and also in standard letterhead size, and copies may be obtained from the Company at Hamilton, Montreal, or any of its branch sales offices.

NEW BRITISH RESEARCH JOURNAL

Messrs. Butterworth and Co. (Canada) Ltd., the Canadian office of the British publishing house of this name, have announced that they will shortly commence publication of a new British journal, *Research*. The list of sponsors of, and prospective contributors to, this monthly publication is most impressive and reads like a roster of eminent British Scientists.

The first issues will contain such titles as: Wartime Development of Diamond Dies—Sir Clifford Paterson, O.B.E., D.Sc., F.R.S.; Glass Research—Professor W. A. Weyl; Theoretical Considerations Regarding High Frequency Gas Oscillations — Charles Hatay; Modern Theories of Molecular Structure—Sir John Lennard-Jones, K.B.E., F.R.S.; Turbulence —Sir Geoffrey Taylor, F.R.S.; Coal Research—D. T. A. Towend, D.Sc., Ph.D., F.R.I.C., D.I.C.

It is likely that Canadian distribution may be somewhat limited until present paper restrictions are eased. Members desiring further information may contact the office of Butterworth's (Canada) at 1367 Danforth Ave., Toronto 6, Ontario.

HUGE TRANSFORMER FOR B.C. ELECTRIC RAILWAY COMPANY

The 69,000-volt primary distribution system of the B.C. Electric Railway Company is to be connected for two-way stand-by service to the 230,000-volt Bonneville system in the state of Washington. For this purpose the English Electric Company's plant in St. Catharines, Ont., has recently shipped the first of two transformers.

The 33,333-kva. unit, the largest ever built in Canada, weighs 225 tons complete and occupies a floor space 34 by 29 ft. The high voltage (230,000 volts) winding was tested before shipment by the application of 100 per cent overload voltage and four railway cars were required for delivery. The main assembly was shipped on a special depressed car with nitrogen gas replacing the cooling oil to reduce weight. A roundabout route was necessary to avoid sections of line not suitable for the unusual load.

CORRESPONDENCE

State Rivers and Water Supply Commission,
100-110 Exhibition Street,
Melbourne, C.1,
Victoria, Australia
June 12th, 1947.

Dear Dr. Wright:

My Commission desires to express its thanks to you for the valuable assistance you rendered Messrs. R. G. Knight and M. G. Speedie during their recent visit to Canada and to convey appreciation through you to the heads of the various organizations who afforded them facilities for inspection of the works. The information they obtained has proved most valuable in connection with the designs for the Eildon project on the Goulburn River.

My Commission would be pleased to extend similar courtesies to any Canadian engineer interested in irrigation works who should be visiting this country.

Yours very truly,

(signed) L. R. East
Chairman.

SOUTH AFRICAN LETTER

In February of this year the *Journal* published the first of what was expected to be a series of South African Newsletters which it hoped might appeal to its readers. The author, W. O. MacLaren, M.E.I.C., has been prevented by the pressure of his work from supplying his comments as often as we would have wished, but his latest contribution has now been submitted and follows herewith.—Ed.

The title of my newsletter this month may be considered to be inaccurate as, having spent so much time in Southern Rhodesia recently, I propose to talk about that country. It may be of some interest to readers of the *Journal* to consider the comparison between the use of rail transport and air transport in making business journeys between Johannesburg and various other places on the Continent of Africa.

Our work, as consulting engineers, has given us appointments in various parts of this continent and, as we are at the moment using Johannesburg as our African headquarters, this involves a great deal of travelling for comparatively long distances. As many of the Canadian engineers who served overseas during the last war realized fully, air transport in England does not compare favourably with air transport in Canada. There are of course, two reasons for this: the small size of the British Isles and, perhaps even more important, the difficulties of the English climate for flying purposes. In respect to air transport the continent of Africa can, in many ways, be compared with Canada. Weather conditions for flying are, at most times of the year, almost ideal and the distances between towns are so great that flying for business purposes becomes a necessity rather than an advisable luxury. My work recently has taken me to Bechuanaland and Northern and Southern Rhodesia and, in six days, necessitated travelling first from Johannesburg to Salisbury, from Salisbury to Bulawayo, from Bulawayo to Livingstone and the Victoria Falls, from Livingstone to a small place on the River Zambesi in Bechuanaland, back to Bulawayo, again to Salisbury, another visit to Bulawayo and the return to my office in Johannesburg. The total air mileage for this six days' journey is approximately 3,000 miles. Most Canadians will agree that this is not a very considerable mileage for six days' travelling but it should be borne in mind that my actual travelling time covered less than three days and the rest of the time was available for work. What I should like to emphasize here is that, had my journey been done by train, the only other alternative mode of transport, it would have taken the best part of two weeks and the journey would have been most uncomfortable and expensive.

To digress a little, I believe that some readers of the *Journal* may be interested to hear my views on the comparison between Niagara Falls and Victoria Falls. It has been my ambition for the last twenty years to see the Victoria Falls and I am particularly glad that I have now been able to see them. At the risk, however, of being most unpopular in this part of the world, I may say at once that I do not think the beauty of Victoria Falls in any way compares with the beauty of Niagara Falls. The main difficulty at Victoria Falls is in finding a place from which a full view of the Falls may be obtained. Were it possible to find such a place it might be possible to be a little more complimentary to the Victoria Falls. Unfortunately, however, I was not able to find a really first-class site for a good view and I must therefore write of what I actually saw.

There is one very decided advantage which Victoria Falls possesses and which Niagara Falls can never again possess. That is the natural unspoiled condition of the immediately surrounding countryside. There are no curio shops or, in fact, shops or houses of any kind immediately adjacent to the Falls and, although this is perhaps a disadvantage in some ways, I feel it is very refreshing to view such a magnificent scene in completely natural and unspoiled surroundings. As an engineer, however, with some business instinct, I feel that it would be very advantageous to the Rhodesias if a really first-class international airport were to be constructed at Livingstone, either as a seaplane base on the River Zambesi or, preferably, a combined seaplane and landplane base and I am sure that this would bring a very large number of visitors to that part of the country. For the reader's interest, the following are vital statistics for comparison between Niagara and Victoria Falls:

	Victoria Falls	Niagara Falls
Height (maximum) . .	347 feet	175 feet
Width (maximum) . .	1,500 yds.	1,316 yds.
Mean annual flow (approximate)	38,430 sec. ft.	205,000 sec. ft.

These figures are as accurate as possible but there seems to be some divergence of opinion as to the relative measurements.

Reverting now to items of more general interest, I feel that it is perhaps advisable to comment upon the general industrial development and possible early engineering development in the Rhodesias. To take first things first, it is, in my view, futile to consider any great industrial development in this country unless communications between various centres are adequately able to cope with increased traffic loads. Fortunately, the Governments of Northern and Southern Rhodesia have realized this and they are now considering and, in fact, embarking upon, a large new programme of construction of additional railway lines. Industrial surveys are now being made in the Sabi River Valley and comprehensive surveys, which will undoubtedly consider the possibilities of hydro-electric development and industrial development generally, are being made jointly by the Northern and Southern Rhodesian Governments. Many immigrants from Britain and elsewhere are being admitted to the Rhodesias under the immigration scheme and this very pleasant country is the goal at which many men and women from the United Kingdom are aiming. The Empire Air Training Scheme trained many men for the Royal Air Force during the last war in Southern Rhodesia and schemes are now being put forward for the development of the Rhodesias for civil aviation.

Like everywhere else, Rhodesia suffers from a housing shortage but strenuous efforts are being made to overcome this and there is no doubt that. with the opening up of the country, it will go ahead very rapidly. My next newsletter will be concerned with Nyasaland, which country I have visited fairly frequently in the last few months.

W. O. MacLaren, M.E.I.C.

Johannesburg, August 13th, 1947.

Personals

News of the Personal Activities of members of the Institute

Dr. Charles Camsell, M.E.I.C., former deputy minister of mines and resources, and a past-president of the Institute, has been appointed to membership in the Federal District Commission at Ottawa, Ont. The commission supervises the parkways and other scenic attributes around the capital city, and is the key body in plans to beautify the administrative area.

F. E. Bronson, M.E.I.C., chairman of the Federal District Commission, Ottawa, Ont., has been re-appointed to that post. He is managing director of the Bronson Company in Ottawa.

Howard Kennedy, M.E.I.C., is practising in Ottawa, Ont., as a consulting engineer. He served in both World Wars, in the latter as chairman of the Officers Selection Board and as quartermaster general of the Canadian Army, retiring with the rank of major-general. He was later vice-president in charge of woods for the Ontario Paper Company Limited and Quebec North Shore Paper Company for two years, and was appointed to the Ontario Royal Commission on Forestry at Toronto in 1946. Prior to service in the recent war he was manager of the Quebec Forest Industries Association Limited at Quebec City.

Dr. C. J. Mackenzie, M.E.I.C., head of the National Research Council and past-president of the Institute, was awarded the Cross of the Legion of Honor in the name of the government of France. Count Jean de Hautecloque, French Ambassador presided at the investiture in Ottawa, Ont., and paid tribute to the success of Dr. Mackenzie's scientific work and its contribution to the termination of the war.

Edward Nelson, M.E.I.C., has retired as chief engineer of the Northwestern Utilities Limited, Edmonton, Alta. A member of the company's staff since its inception, he served as an engineer from 1923 to 1925, when he was given the post of chief engineer. He has remained in Edmonton during most of his service with the company, and has been instrumental in the company's achievements in gas research. He is an active member of the Edmonton Chamber of Commerce, and the Alberta Chamber of Mines and Resources. He is a past-chairman of the Edmonton Branch of the Institute and in 1943-44 represented the branch on the council of the Institute.

R. D. Sutherland, M.E.I.C., is appointed assistant general sales manager of the radio and appliances division of Rogers Majestic Limited and DeForest Radio Limited. He will be located at Leaside, Ont. He joined the company in 1946 as eastern district manager at Montreal after service with the rank of brigadier with the Department of National Defence at Ottawa, Ont., and as Q.M.G. for the Atlantic Command at Halifax. Before the war he was merchandise manager for Canadian Westinghouse Company Limited, Montreal.

A. R. Bennett, M.E.I.C., of Canadian National Railways, Moncton, N.B., has been elected chairman of the Moncton Branch of the Institute. He was born in Caledonia, N.B., and attended schools there. He joined the C.N.R. in 1906 in Moncton as a machineman, but in 1913 he went to Hyde Park, Mass., as a draughtsman for the B. F. Sturtevant Company. During his two years with that company he studied machine designing in Boston, Mass., and he returned in 1914 to C.N.R. as a draughtsman. From 1920 to 1922 he was a salesman for Canadian Sirocco Company in Montreal and in Halifax, N.S. He returned to C.N.R. in Moncton in 1923, working as a draughtsman on water and pump installations, heating systems of buildings and steam power plants. He received his present appointment in 1944 as assistant engineer in the office of the general superintendent of motive power and car equipment at Moncton.

G. N. Martin, M.E.I.C., chairman of the Institute Committee on Employment Conditions was recently elected as a trustee of the American Boiler Manufacturer's Association. A graduate of Ecole Polytechnique, Montreal, in 1934, and presently professor lecturing in boiler design at the Ecole, Mr. Martin has been with the Dominion Bridge Company since his graduation, with the exception of two years leave when he studied modern combustion engineering under the Central Electricity Board, London, England. He was appointed combustion sales engineer of the bridge company in 1944. He is a past chairman of the Canadian Steel Boiler Institute.

C. A. Laverty, M.E.I.C., chairman of the Montreal Branch entertainment committee, has been transferred to Toronto, Ont., to be assistant chief engineer for the Boiler Inspection and Insurance Company of Canada. He has been in the Montreal office of the company since 1931.

G. C. Gauthier, M.E.I.C., has accepted employment with the Aluminum Company of Canada Limited at the Saguenay Terminals at Port Alfred, Quebec. He was previously an electrical engineer with Marine Industries Limited, Sorel, Que.

H. E. Cunningham, M.E.I.C., is the new manager and chief engineer of the paper machinery division of Dominion Engineering Company Limited, Montreal. A graduate of McGill University, he has been with the Company since 1934. He was assistant chief engineer prior to his present appointment.

G. E. Kent, M.E.I.C., of the Imperial Oil Company is transferred from his position as assistant superintendent of the Regina Refinery to the head office of the company in Toronto. He will work on the engineering aspect of budgets and economics.

S. T. Lewis, M.E.I.C., has been transferred from Regina, Sask., to Victoria, B.C., to be division engineer and assistant superintendent for the Esquimalt and Nanaimo Railway. He has been district engineer at Regina for the Canadian Pacific Railway for some years.

W. R. Meredith, M.E.I.C., is practising as a patent engineering consultant in Ottawa, Ont. Formerly he did patent engineering for a firm of patent attorneys in Ottawa. He is a Queen's University graduate of the class of 1945, with the degree of B.Sc. in mechanical engineering.

J. L. Miller, M.E.I.C., has been with the British Columbia Electric Railway, Vancouver, B.C., since May 1st, as a structural engineer. He was formerly with Arthur Pearson, Vancouver consulting engineer.

E. A. Phillips, M.E.I.C., has accepted a position as building superintendent with the Hudson Bay Company Limited in Vancouver, B.C. He was previously city engineer of Prince Rupert, B.C.

R. L. Bartlett, Affiliate E.I.C., has been since February last with the engineering department of Pacific Mills Limited at Ocean Falls, B.C. He had been with Heaps Engineering Limited at Vancouver from December 1945, when he went to that city from Toronto, Ont.

D. R. Beckett, Jr.E.I.C., the new secretary-treasurer of the Lakehead Branch of the Institute, is a graduate of Queen's University, with a B.Sc. degree in civil engineering received in 1945. He is assistant resident engineer of the Nishin Lake Spur Line construction for Spruce Falls Power and Paper Company, Kapuskasing, Ont.

W. F. S. Carter, Jr.E.I.C., became general manager of Sir George Godfrey and Partners (Canada) Limited, Montreal in May last. He had been with Continental Can Company of Canada Limited at St. Laurent, Que., from 1945, when he was released from the R.C.A.F. with the rank of squadron leader.

A. H. Holden, Jr.E.I.C., who recently joined E. F. Drew and Company in Montreal, is now acting as assistant technical director in the field of boiler water conditioning, in collaboration with W. J. Tomlinson, M.E.I.C., recipient of the Institute's Plummer Medal for 1946.

J. Blair Scott, Jr.E.I.C., has accepted a position with the Abitibi Pulp and Paper Company at the mill at Iroquois Falls, Ont. He was previously at Dominion Engineering Works Limited, Montreal, as junior mechanical engineer.

D. L. Seymour, Jr.E.I.C., is employed as engineer on the board of Works of the City of Peterborough, Ont. He has recently been at R.M.C., Kingston, Ont., after serving for some time as a sanitary engineer with the Public Health engineering division of the Department of National Health and Welfare at Ottawa, Ont.

C. C. Tompkins, Jr.E.I.C., is with Plate and Structural Steel Products in Toronto. He had been employed by Canadian Hanson and Van Winkle Company in that city since his graduation from Queen's University in 1945.

G. Weso, Jr.E.I.C., is at Timagami, Ont., employed by the Hydro-Electric Power Commission of Ontario. He was previously with the Saskatchewan Power Commission at Regina.

W. Douglas Baines, S.E.I.C., is at the Iowa Institute of Hydraulic Research in Iowa City. He graduated this year from the University of Alberta with a B.Sc. in engineering physics, and won the Henry Birks and Sons gold medal in applied science.

D. B. Brown, S.E.I.C., received the B.Eng. degree, electrical, from McGill University this year, and is employed by the Montreal Engineering Company Limited in Montreal.

A. E. A. Love, S.E.I.C., is now employed by the Consolidated Paper Corporation Limited at Shawinigan Falls, Que. He received a B.Eng. degree, mechanical, from Nova Scotia Technical College this year.

E. P. Miller, S.E.I.C., is with the Kellett Aircraft Corporation of North Wales, Pennsylvania. He is an aerodynamics engineer in the research and development group. He was previously a junior engineer for the Dominion department of transport at the Welland Ship Canal office at St. Catharines, Ont.

Harold Richman, S.E.I.C., who graduated this year from the University of Manitoba with a B.Sc. degree in electrical engineering, has been employed by the Howard Smith Paper Mills Limited in Montreal.

C. O. J. Schmidt, S.E.I.C., has been assigned to the manufacturing methods department of Westinghouse Electric Corporation, Hamilton, Ont. Following graduation this spring from the University of Manitoba with a B.Sc. in electrical engineering, he was employed by the company in the engineering apprenticeship course.

Obituaries

The sympathy of the Institute is extended to the relatives of those whose passing is recorded here.

William Murray Reid, M.E.I.C., of Westmount, Que., died at his home on June 28th, 1947. The former engineer, maintenance of way and structures for Montreal Tramways Company had retired from the company last year.

He was born in Montreal in 1864 and attended McGill University graduating with a B.A.Sc. degree in mechanical engineering in 1886. He worked first for Messrs. Jno. Laurie and Bro., on draughting, and was employed subsequently by various firms, among them being the Dominion Safety Boiler Company Limited, Montreal, the International Boiler Company Limited in New York, the Royal Bridge and Iron Company Limited at Outremont, Que., the Canada Switch Manufacturing Company Limited, Montreal, and the Canadian Steel Foundries Limited, Montreal. He was with the Montreal Tramways Company for 42 years until his retirement at 81, which was ample testimony to the value of his services. There he was office engineer and later assistant engineer, maintenance of way and structures, before his appointment some years ago to the position of engineer, maintenance of way and structures. In his particular field of work he was a recognized authority.

He was among the first members of the Institute, joining as a Student in 1887, the year in which it was established as The Canadian Society of Civil Engineers, and he transferred to Associate Member in 1895 and to Member in 1940. He was awarded Life Membership in January, 1946.

Alex R. Greig, M.E.I.C., formerly of the staff of the University of Saskatchewan, died on July 21st, 1947. Professor Greig had retired in 1937 from the university staff as head of the departments of mechanical and agricultural engineering but he retained his position as superintendent of buildings until 1939.

Born in Montreal in 1872, he graduated in mechanical engineering from McGill University in 1895 with a B.A.Sc. degree. Before entering the university he had spent three years as a machinist apprentice with the Laurie Engine Company in Montreal. On graduating he joined the Canada Atlantic Railway in Ottawa, Ont., as chief draughtsman in the mechanical department, and seven years later he went in the same capacity to Canadian Northern Railway in Winnipeg, Man. He was for three years professor of agricultural engineering at Manitoba Agricultural College in Winnipeg and in 1909 he joined the original staff of the newly-formed University of Saskatchewan with the appointment of professor of mechanical engineering. He was also superintendent of buildings for the University from that time until his retirement. In 1912 he assumed the added duties of professor and head of the department of agricultural engineering, and in 1922 he was made head of the department of mechanical engineering. Professor Greig emerged from retirement during the war to become acting professor of mechanical engineering at the University of Alberta for three years.

Professor Greig served on the Saskatchewan Highway Commission from 1913 to 1916, and on the Saskatchewan Power Resources Commission in 1927-28. He was chairman of the board of conciliation for the Industrial Dispute Commission for owners and coal miners at Estevan in 1938. He published material on wall insulation and on the construction of farm buildings.

Professor Greig joined the Institute as a Student in 1895, transferring to Associate Member in 1909 and to Member in 1919. He was awarded Life Membership in 1938.

Pierre Piché, M.E.I.C., of Terrebonne, Que., died at his home on July 10th, 1947. Born in 1868, he attended Polytechnique in Montreal, graduating in 1892.

From 1894 to 1903, he resided in the United States, where he was employed successively by the Shiffler Bridge Company, the Carnegie Steel Company and the Cambria Steel Company. Back in Canada in 1903, he was engaged in private practice in Montreal until 1908, during which time he was also "chargé de cours" at Polytechnique for some years.

In 1908, he joined the Department of Railways and Canals in Montreal. From 1916 to 1920, he was in Quebec with the Highway Department. In 1920, however, he came back to the Railways and Canals department, where he devoted the last part of his career to maintaining, extending and improving the canal system of the Province of Quebec. On his retirement in 1936, he was superintending engineer for the Province.

Mr. Piché joined the Institute in 1899 as an Associate Member and was transferred to Member in 1940.

Garnet Affleck, M.E.I.C., of Winnipeg, Man., died on January 1st, 1947.

Born at Middleville, Ont., in 1884, he was educated there and started working with the National Transcontinental Railway in 1905. He served as chairman, rodman, topographer, leveller, transitman and instrumentman, and was appointed district resident engineer in charge of construction in 1910. From 1913 to 1915 he was resident engineer in charge of construction for the Kettle Valley Railway in British Columbia. In 1916 he went to Winnipeg, Man., and joined the provincial Department of Public Works, Reclamation Branch, as engineer in charge of drainage and roads. He became district engineer at Winnipeg soon after and held that position until his death.

Mr. Affleck joined the Institute as a Student in 1909, transferring to Junior in 1912, to Associate Member in 1920 and to Member in 1940.

Oliver L. Flanagan, M.E.I.C., of Toronto, Ont., died on July 21st, 1947, after a short illness. Born in Simcoe County, Ont., he was an engineering graduate of the University of Toronto, having specialized in hydraulic and mechanical engineering. He was associated first with hydraulic work in Ontario and Saskatchewan, and he worked on construction of the Canadian Northern Railway in Ontario, and on the development of mining interests in Cobalt, Ont. Later he went to South America and Brazil for the El Pasco Mining Corporation, returning to Canada about 1920.

He was at one time engineer in charge of the Hudson Bay Mining and Smelter Company of Flin Flon, Man., and was in charge of the construction of the Island Falls Power development on the Churchill River as well as making investigations for the water storage on Reindeer Lake, Northern Manitoba. He was engaged in investigations in connection with power development for mining companies both in Northern Manitoba and Northern Quebec.

Recently Mr. Flanagan completed hydraulic studies and developments in New York State for American interests. Shortly before his death he had been actively associated with the Ontario Hydro Electric Power Commission in making studies in connection with the St. Joachin development of the Ottawa River.

Mr. Flanagan joined the Institute in 1913 as an Associate Member, transferring to Member in 1940.

William Smaill, M.E.I.C., who until his retirement two years ago, was chief engineer for the Northern Construction Company and J. W. Stewart Limited, died at Vancouver on July 3rd, 1947.

Born in Montreal in 1870, he graduated from McGill University in 1890 with a B.A.Sc. degree. His early career was largely in mining engineering work in Ontario, and from 1903 to 1918 his work took him to various parts of Canada and the United States, involving design and construction of large projects, mainly power developments. Some of these projects were the Great Northern Power Company's development near Duluth, Minn. 1905-07; the St. Anthony Falls Water Power Company plant at Hennepin Island, 1907; the power house for the St. Lawrence River Power Company at Massena, N.Y., 1909; the Mayo Bridge in Virginia, 1911; the Parr Shoals Power Company development in South Carolina, 1911; and the reinforced concrete bridge at Alderson, West Virginia. He was general superintendent of the Winnipeg Aqueduct Construction Company's contracts on the Greater Winnipeg Water District Aqueduct for several years.

He was with the Northern Construction Company and J. W. Stewart Limited for over thirty years and during that period was responsible for the construction of many large projects all across Canada and in the United States. Some of the larger contracts coming under the late M. Smaill's supervision included the Ballantyne Pier, Vancouver; Greater Winnipeg Water Supply; Great Falls Power Development, Manitoba; Section 8 Welland Ship Canal; C.N.R. Central Station Excavation, Montreal; Toronto Water Filtration Plant; Wolfe's Cove Terminals, Que., and West Saint John Harbour reconstruction. The contracts in the United States included several large tunnels in California and Massachusetts.

Mr. Smaill had been a member of the Institute since 1918.

C. C. Folger, M.E.I.C., general manager of the Public Utilities Commission of Kingston, Ont., died in hospital on December 22nd, 1946. He was born in Kingston, in 1875, and attended Kingston Collegiate Institute and Queen's University. After some time spent in the mining industry in Northern Ontario, he returned to Kingston and entered the Kingston Light, Heat and Power Company. From 1904 to 1912 he was general superintendent of the gas and electric divisions of the company, and he was already general manager for several years when the Kingston Public Utilities Commission was formed in 1914. At his death he had served the city as manager of the commission for over thirty years.

Mr. Folger held membership in the Canadian Gas Association, the Canadian Section of the American Waterworks Association and the Association of Professional Engineers of Ontario. He joined the Institute as a Member in 1941.

News of the Branches

Activities of the Twenty-eight Branches of the Institute and abstracts of papers presented

MONTREAL BRANCH

Opening night will be held on Wednesday, October 1st, 1947 at 8.30 p.m. in Cardy Hall, the Mount Royal Hotel. By making use of Cardy Hall it is expected that the overcrowding of previous years will be avoided and a wide attendance is expected. A social gathering for the discussion of Institute affairs, the evening will also offer an opportunity to receive our new President, Lieut.-Col. L. F. Grant.

The programme will include a short talk by Dr. Massue on Institute membership; the election of a Nomination Committee; the introduction of new members, and an address from the President. The President will also make the presentation of Institute prizes. There will be remarks by our branch chairman, and members will be given an opportunity to briefly discuss these remarks.

Refreshments will include sandwiches, cheese, coffee, soft drinks and beer. Provision will be made so that members desiring beverages beyond those provided by the branch may purchase them *a la carte*.

Because the gathering is expected to be large, each member is requested to wear the card which will be issued to him on arrival and for identification to inscribe his name legibly thereon.

Regarding certain lecture meetings to be held in the coming session at which a large attendance may be expected, it has been decided by the Executive that due to the limited facilities at Headquarters it may be well to limit the meetings to members only. To this end members will be given advance notice when they will be asked to produce their notice cards at the door for admission. Guests should be accompanied by a member in all cases, the guest's name being inscribed upon the member's card and it is felt that on certain occasions it may not be possible to admit guests. The Executive will appreciate the co-operation and understanding of members in this matter.

It has been reported in the press that medical and dental officers were going to receive special pay and rank in the permanent forces of Canada. The Montreal Branch has forwarded a resolution to the Council for consideration, asking that representations be made to provide for similar treatment in the case of engineer officers. We understand that action has been taken but a reply has not yet been received.

For the information of members who were not present at the Annual Meeting held last January, the vote on the revised by-laws of the Branch showed that these had been almost unanimously approved.

A meeting of the Engineers' Council for Professional Development (E.C.P.D.) will be held in Montreal October 24th and 25th, and as a number of the visitors will be staying in town over the Sunday, the branch has been asked to assist in their entertainment. To this end the Executive has stated its willingness to provide transportation for the purpose of conducting the visitors to various places of interest in and around town, and therefore it would be appreciated if members who would like to provide their cars for this purpose would let the Branch Secretary-Treasurer know as soon as possible. Further details will be given in due course to those volunteering to do so.

We would like to congratulate L. C. Jacobs on his appointment as Institute Treasurer. A number of changes in the personnel of Branch Committees includes H. M. Finlayson, The Shawinigan Water & Power Co., who succeeds Lester McGillis as chairman of the Membership Committee; R. H. Hobner, The Dominion Textile Company, succeeds C. A. Laverty who has been moved to Toronto, as chairman of the Entertainment Committee. The Executive has a special word of praise for C. A. Laverty who has so unselfishly and with such success given his time and effort for several years to the work of this committee.

Junior Section

The summer is an inactive season for the Junior Section in that no meetings are taking place, the last meeting having been held on April 7th when Mr. D. P. Hatch spoke on **Canada's Exporting Business**. Mr. Hatch's lecture ended a most successful and well-attended session which appeared to justify the policy of the Papers Committee to lay more emphasis on non-technical subjects at the meetings.

The response of the junior members to this policy was continuous all through the session; large gatherings at lectures such as **How to Train Your Mind** by Dr. S. A. Bois, **Appreciation of Music** by the dynamic young musician, Francis Coleman, **Canada's Resources** by Dr. John S. Bates, or **Canada's Exporting Business** by D. P. Hatch, are proof of the interest shown by the young engineer in subjects of general cultural value. The young engineer feels that psychology, human relations, effective speaking, music, and problems of business and the nation, as much as physics, chemistry or mechanics, play an important role in his development as a real engineer.

During the summer the Executive Committee of the Junior Section prepared the programme of events for the coming season, a partial list of which is given below. An effort has been made to get away somewhat from specific technical subjects. Not that none have been considered, however, but the immediate response given last year to subjects of a general cultural nature considerably influenced the Executive in its choice.

The Opening Night meeting will be held on October 6th. There will be a talk on **The Young Engineer** by a leading authority on the subject, the name of the speaker to be announced later. No doubt such a subject will be of great interest to junior members who are eager to know what place the young engineer should occupy, what his elders expect from him, and what he can expect from his immediate superiors. Refreshments will be served at the end of the evening.

TOPICS AND EVENTS FOR THE FIRST SESSION 1947-48

October 6—**The Young Engineer.**

October 20—Topic on Northern Engineering Methods (to be announced).

November 3—**The Development of Hydro-Electric Power.**

November 17—Students' Night and Films.

November 28—Annual Dance.

December 8—**Requisite Fundamentals in Supervisors and Supervision.**

ANNUAL DANCE

The Junior Section will hold its annual dance on Friday, November 28th, at the Ritz-Carlton Hotel. Because of the popularity of this event in previous years, it has been decided that ticket sales must be restricted and none will be sold at the door. Leo Scharry is Chairman of the committee and he may be contacted for tickets or further details at Room 819, Tramways Biulding, Montreal.

Library Notes

Book notes, Additions to the Library of The Engineering Institute, Reviews of New Books and Publications

BOOK REVIEW

WOMEN CAN BE ENGINEERS

Alice C. Goff. Youngstown 4, Ohio, The Author, 1946. 227 pp., 8¾ x 5½ in., cloth, $2.50.

Reviewed by ELSIE GREGORY MACGILL, M.E.I.C.*

The title of the book is a statement of its thesis. A short Foreword discusses generally the entrance of women in the engineering field; the balance of the book cites the cases of 19 women successfully engaged in professional and other engineering work. (The author modestly refrains from mentioning herself; she is a structural engineer.) The women mentioned are all English-speaking—16 are American, 2 English, 1 Canadian. This purposely holds the subject at a commonplace and understandable level for readers on this continent, and avoids the unreal effect that the inclusion of foreign women might introduce. 19 cases are considered adequate for the purposes of the book, and any omissions are to be viewed in this light.

All the women mentioned are living and are practicing engineers. Their fields include civil (4), metallurgical (1), aeronautical (4), electrical (2), chemical (1) and the related fields of paleontology (1), architecture (1), biology (1), physics (1) and manufacturing (1). In one way or another, they have all been "the first woman"—perhaps to receive a certain degree from a certain university; or to be admitted to a learned society, professional or trade association; or to receive a certain award, medal or honorary degree. Since they are all women who have attained some recognition in their field, they have been active for some time, the minimum working period being over 18 years, while some have been practicing for over 40 years. This fact lends weight to the book's argument.

The story of each woman's life and work—her early environment, aptitudes, schooling, engineering training, accomplishments and awards—as far as Miss Goff knew them—is set down. The amount of data varies considerably from case to case, and it is apparent that Miss Goff laboured under the tremendous handicap of lacking contact with some of her subjects. This does not affect the general purpose of the book, nor its interest. It is colourfully written, and gives remarkably full descriptions of some aspects of the work undertaken (time motion study, spot welding, food refrigeration, air conditioning, railway coach interiors, gold recovery, electrical transmission problems, statistical surveys, oil drilling and refining, metal drawing, highway engineering, research in glass).

The book is of general interest to engineers and readers of biography. It will be useful to those who specialize in vocational guidance, and to sociologists. The descriptions given of engineering work, and training prerequisites, will clarify and brighten the subject for both boys and girls, while the familiar childhood pattern of these women will encourage young adults to feel confidence in their own potentialities. To the sociologist who is interested in the social changes on this continent, it furnishes a precise record of a changing attitude, telling when, how and for whom, the walls came tumbling down.

ADDITIONS TO THE LIBRARY

TECHNICAL BOOKS, ETC.

College Physics; Mechanics, Heat, and Sound:
Francis Weston Sears and Mark W. Zemansky. Cambridge, Mass., Addison-Wesley, 1947. 402 pp., illus., cloth.

Dynamic Motion and Time Study:
James J. Gillespie. London, Elek, 1947. 95 pp., illus., paper.

Electrical Engineering; Problems and their Solutions:
T. F. Wall. Brooklyn, Chemical Publishing Co., 1947. 312 pp., illus., cloth.

Electronic Control Handbook:
Ralph R. Batcher and William Moulic. New York, Caldwell-Clements, c1946. 344 pp., illus., cloth.

Elementary Theory of Gas Turbines and Jet Propulsion:
J. G. Keenan. Oxford University Press, 1946. 261 pp., illus., cloth.

Elements of Electrical Engineering; a Textbook of Principles and Practice; 5th ed:
Arthur L. Cook and Clifford C. Carr. New York, Wiley, 1947. 662 pp., illus., cloth.

Engineering Economics and Practice; including Solutions to problems in Professional Engineer Examinations, New York State:
Max J. Steinberg and William Glendinning. c1947. 101 pp., illus., paper.

English County; a Planning Survey of Herefordshire:
West Midland Group on Post-War Reconstruction and Planning. London, Faber, 1946. 266 pp., illus., cloth.

Falk's Graphical Solutions to 100,000 Practical Problems:
Karl H. Falk. Columbia, Connecticut, Columbia Graphs, c1946. 402 pp., illus., cloth.

ICAO Regional Manual; North Atlantic:
Montreal, International Civil Aviation Organization, May 15, 1947. illus., leather.

Oil Heating Handbook; a Manual of Theoretical and Practical Considerations Entering into the Manufacture, Installation and Use of Oil Burners in Moderate Size Heaters Including a Complete Oil Heating Terminology, 3rd ed. rev:
Han A. Kunitz. Philadelphia, Lippincott, c1947. 464 pp., illus., cloth.

Practical Theory of Mechanisms; Classification and Description of Mechanisms Applied in Machines and Instruments:
Paul Grodzinski. Manchester, Emmott, 1947. 166 pp., illus., cloth.

Precision Hole Location for Interchangeability in Toolmaking and Production; Including Woodworth Circular Tables:
J. Robert Moore. Bridgeport, Connecticut, Moore Special Tool Company, c1946. 448 pp., illus., cloth.

Preliminary Mathematics for Engineers; a Book Suitable for Students in all Kinds of Engineering, Installation Work, Telegraphy and Telephony, Excluding the Calculus; 3rd. ed:
W. S. Ibbetson. London, Spon, 1947. 175 pp., illus., cloth.

Principles of Electrical Engineering; Heavy-Current and Light-Current Engineering Practice:
T. F. Wall. Brooklyn, Chemical Publishing Co., 1947. 563 pp., illus., cloth.

Steel Castings:
Eric N. Simons. Brooklyn, Chemical Publishing Co., 1947. 208 pp., illus., cloth.

*Consulting Engineer, Toronto, Ont.

Tables Numeriques Universelles des Laboratoires et Bureaux d'Etude; Operations Arithmetiques, Expressions Trigonometriques Exponentielles; Probabilites Grandeurs Reelles et Complexes Calcul des Formules Usuelles Conversion des Unites:

Marcel Boll. Paris, Dunod, 1947. 882 pp., illus., cloth.

Union List of Technical Periodicals in Two Hundred Libraries of the Science-Technology Group of the Special Libraries Association, 3rd ed:

Elizabeth Gilbert Bowerman. New York, Special Libraries Association, 1947. 285 pp., paper.

PROCEEDINGS, TRANSACTIONS ANNUALS, ETC.

Britannica Book of the Year, 1947; a Record of the March of Events of 1946:

Walter Yust. Chicago, Encyclopaedia Britannica, Inc., c1947.

Canada Census. Eighth Census of Canada, 1941:

Volume III: Ages of the Population Classified by Sex, Conjugal Condition, Racial Origin, Religious Denomination, Birthplace, Etc. Ottawa, 1946. Dominion Bureau of Statistics.

Canadian Institute of Mining and Metallurgy; and Mining Society of Nova Scotia:

Transactions, Volume 49, 1946.

National Research Council of Canada:

Thirtieth Annual Report, 1946-1947.

Society for Experimental Stress Analysis:

Proceedings, Volume 4, Number 2, c1947.

TECHNICAL BULLETINS, ETC.

American Gas Association. Committee on Domestic Gas Research:

Report No. 1—Literature Review on Corrosion of Metals and Material by Flue Gas Condensate.

Central Mortgage and Housing Corporation:

Builder's Bulletin No. 6.—Integrated Housing Plan.

Canada. Bureau of Mines (Publications):

816—Physical Properties of Canadian Building Brick.—822—Physical Properties of Canadian Structural Tile.

Electrochemical Society:

Preprints: 91-34-H—Electric Activation of Chemical Reactions.—92-I—Rate of Oxygen Absorption by Alpha Ray Cuprene.

National Research Council. Information for the Press:

Release No. 11—Report on the National Research Council's Radiant-Heating Project.—No. 12—National Research Council and Mines Department Plan Aerial Geological Survey.

Training Within Industry Bulletin Series:

Bulletin No. 5—Training Timetables.—No. 6—Supervisory Selection.—No. 7—Improved Methods.

U.S. Geological Survey:

Publications of the Geological Survey, not Including Topographic Maps.

...Bulletin:

945-F—Chromite Deposits near Red Lodge, Carbon County, Montana.—948-A—Tungsten Deposits of Vance County, North Carolina and Mecklenburg County, Virginia.—952—Bibliography of North American Geology, 1944 and 1945.—953-A—Antimony Deposits of the Tejocotes Region, State of Oaxaca, Mexico.—953-B—Manganese Deposits of the Republic of Haiti.

...Professional Paper:

142-H—Molluscan Fauna of the Alum Bluff Group of Florida; Part 8, Ctenobranchia (Remainder), Aspidobranchia, and Scaphopoda.—210-D—Bulimina and Related Foraminiferal Genera.—214-A—Upper Cretaceous Ammonites from Haiti.

...Water-Supply Paper:

920—Utilization of Surface-Water Resources of Sevier Lake Basin, Utah.—969—Geology and Ground-Water Resources of Box Butte County, Nebraska.—1017—Water Levels and Artesian Pressure in Observation Wells in the United States in 1944, Part 2. Southeastern States.—1037—Surface Water Supply of the United States, 1945, Part 7. Lower Mississippi River Basin.—1038—Surface Water Supply of the United States, 1945, Part 8. Western Gulf of Mexico Basins.

STANDARDS, SPECIFICATIONS, ETC.

American Institute of Electrical Engineers Subcommittee on Aircraft Systems of the AIEE Committee on Air Transportation:

Report on Aircraft Electric System Guide. AIEE No. 750, July, 1947.

American Society for Testing Materials. Specifications:

ASTM Standards on Concrete and Concrete Aggregates.

American Standards Association. American Standard Building Requirements:

A87.1-1947—Steel Joist Construction.

British Standards Institution. Standards:

1389:1947—Hose Connections for Welding and Cutting Appliances.

PAMPHLETS, ETC.

Analytical Services:

New York, Foster D. Snell, Inc., c1947.

British Empire Forestry Conference: (Union of South Africa)

Comparative Efficacy of Preservatives in Wood Exposed to Termites and Decay, by P. M. D. Krogh.—Conservation of Existing Forests and the Need to Plant Forest Trees for Effective Soil Conservation in the Union of South Africa, by W. E. Watt.—Empire Forests and the War.—Hydrological Research in South African Forestry, by C. L. Wicht.—Potentialities of Genetic Research in South African Forestry, by S. P. Sherry.—Quality of Mature Pinus Patula and P. Insignis Timber Grown in South Africa, by M. H. Scott and R. P. Stephens.—Silviculture of Exotic Conifers in South Africa, by I. J. Craib.—Some Factors Affecting Wood Density in Pine Stems, by John M Turnbull.

Careers in the Mineral Industries; 3rd rev. ed:

Thomas T. Read. New York, American Institute of Mining and Metallurgical Engineers, 1946.

Combustion Systems and Burners:

Henry Schramm. Toledo, Surface Combustion Corporation, 1947.

Energy Sources of Tomorrow:

Ralph A. Sherman. 1947.

Engineering a World that Works:

H. Birchard Taylor. Engineering Institute of Canada, 1947.

Engineers' Council for Professional Development: Record of Accomplishment—1932-1947:

New York, Engineers' Council for Professianal Develapment. 1947.

Infra-Red in Industry:

William J. Miskella. Cleveland, Miskella Infra-Red Campany. c1947.

Job Ahead:

R. W. Diamond. American Institute of Mining and Metallurgical Engineers, 1946.

Market Research:

New York, Foster D. Snell, Inc., c1947.

Planning Canada's Capital:

Ottawa, Argo, 1946.

Relieving Congestion with Improved Transit:

Leslie Williams. New York, Municipal Forum, 1947.

Resistance of Iron-Nickel-Chromium Alloys to Corrosion in Air at 1600 to 2200 F:

Anton De S. Brasunas, James T. Gow, and Oscar E. Harder Philadelphia, American Society for Testing Materials, 1946.

Truth about the Machine:

Detroit, American Society of Tool Engineers, 1947.

Use of the Multipress in Cutting Test Specimens:

Ellsworth E. McSweeney and La Verne E. Cheyney. Columbus, Ohio, Battelle Memorial Institute, 1947.

BOOK NOTES

The Institute does not assume responsibility for any statements made; they are taken from the preface or the text of the books.

Prepared by the Library of The Engineering Institute of Canada

OPERATION OF JOB EVALUATION PLANS; A SURVEY OF EXPERIENCE:

Helen Baker and John M. True. Princeton University, Industrial Relations Section, Princeton. 1947 111 pp., paper, $1.50. (Research Report Series No. 74).

This report is the second in a series concerned with the machinery of determining wages. The emphasis is placed, in this study, on experience in the continued operation of job evaluation programmes rather than on first installation. For the first report see WAGES UNDER NATIONAL AND REGIONAL COLLECTIVE BARGAINING in the Engineering Journal, (V. 30, N. 7, July, 1947, p. 358.)

The following notes on new books appear here through the courtesy of the Engineering Societies Library of New York, and may be consulted at the Institute Library.

A.S.T.M. STANDARDS ON CONCRETE AND CONCRETE AGGREGATES:

Prepared by A.S.T.M. Committee C-9; Specifications, Methods of Testing, Definitions, February, 1947. American Society for Testing Materials, 1916 Race St., Philadelphia 3, Pa. 149 pp., illus., diagrs., tables, 9 x 6 in., paper, $2.00; to A.S.T.M. members, $1.50.

Of the 53 standards presented in this useful compilation, some 15 each are devoted to test methods for concrete and for concrete aggregates. The remaining items are standard and tentative specifications for concrete, aggregates, natural and portland cements, concrete curing materials, concrete reinforcement, expansion joint fillers, and sieves for testing purposes. The main arrangement is classified, with an additional list of the contents in numeric sequence.

AUTOMOTIVE MECHANICS:

W. H. Crouse. McGraw-Hill Book Co., New York and London, Toronto, 1946. 673 pp., illus., diagrs., charts, tables, 9¼ x 6 in., cloth, $4.50.

Chapters 1 and 2 of this comprehensive manual discuss the various components of the automobile and the physical principles involved. Chapters 3 to 14 pertain to the power plant, including the engine and the fuel, lubrication, cooling, and electric systems. Chapters 15 to 29 cover the power train, chassis and body. The final chapter is devoted to shop practice and the use of tools. Each topic is considered in the following order: theory of operation and construction of the mechanism; possible troubles that might occur, diagnosis, and correction of troubles, including disassembly, repair and reassembly. The practical aspects are emphasized throughout.

ELECTRONIC CONTROL HANDBOOK:

R. R. Batcher and W. Moulic. Caldwell-Clements, Inc., 480 Lexington Ave., New York, 1946. 344 pp., illus., diagrs., charts, tables, 9 x 5¾ in., leatherette, $4.50.

The electrical and electronic principles employed in automatic control and regulation services are discussed in detail with emphasis on the versatility of electronic systems. Following the opening section which gives the basic elements of control, separate sections are devoted to the three main parts of a control system: the conversion element (displacement, pressure, temperature, etc.) which activates the electronic circuit; the electronic modification circuit itself (amplifiers, oscillators, bridges, etc.); and the activation or correction element which produces the required change. The final section describes specific control applications.

ELEMENTARY THEORY OF GAS TURBINES AND JET PROPULSION:

J. G. Keenan. Oxford University Press, New York, Toronto; Geoffrey Cumberlege, London, 1946. 261 pp., illus., diagrs., charts, tables, 9 x 5½ in., cloth, 12s.6d. ($5.00 in U.S., $4.50 in Canada.)

This treatise presents the basic principles of the gas turbine in as simple a manner as possible while retaining the mathematical essentials. The concept of entropy is omitted, and the changes in the condition of the gas flow are dealt with on a pressure-volume basis. The history of the gas turbine is briefly traced, followed by chapters on the air cycle, compressors, combustion chambers, nozzles, heat exchangers, impulse and reaction turbines, gas turbine efficiences and calculations. Descriptions of installations for locomotives, ships, generating stations, and gas turbine-airscrew aircraft are given, with a special chapter on aircraft jet propulsion.

ENGINEERING ECONOMICS AND PRACTICE, INCLUDING SOLUTIONS TO PROBLEMS IN PROFESSIONAL ENGINEER EXAMINATIONS, NEW YORK STATE:

M. J. Steinberg and W. Glendinning. Apply W. Glendinning, 5123 Bell Blvd., Bayside, New York, 1947. 101 pp., diagrs., charts, tables, 11½ x 8½ in., paper, $3.00.

This book covers the basic principles of engineering economics and practice. The principles have been reduced to a formula basis with each of the terms clearly defined. Each chapter includes problems of a practical nature that illustrate the principles involved. Questions and solutions to the problems in Engineering Economics and Practice from the New York State Professional Engineering examinations are an important supplement to the text material.

FALK'S GRAPHICAL SOLUTIONS TO 100,000 PRACTICAL PROBLEMS:

Prepared and edited by K. H. Falk. Columbia Graphs, Columbia, Connecticut, 1946. 402 pp., charts, 9½ x 6 in., cloth, $6.00.

This volume contains 400 worked-out graphs covering standard calculations for a large variety of practical problems in mechanics, hydraulics, electricity, physics, chemistry, shop-work, construction, trigonometry, weights and measures. The graphs are all of the simple type in which the intersection of two lines, established by the known quantities, provides the direct answer.

INFRA-RED IN INDUSTRY:

W. J. Miskella. Miskella Infra-Red Company, Cleveland 4, Ohio, 1947. 64 pp., illus., diagrs., charts, tables, 7½ x 5 in., paper, $2.00.

The construction and operation of infra-red equipment for industrial uses are explained in this trade pamphlet. Diagrams and charts are used to show structural details and furnish technical data.

OIL HEATING HANDBOOK:

H. A. Kunitz, 3 ed. rev. J. B. Lippincott Co., Philadelphia and London; Longmans, Green, Toronto, 1947. 464 pp., illus., diagrs, charts, tables 7¾ x 5 in., cloth, $5.00, ($6.50 in Canada.)

Following an introductory section describing oil burner systems and types, this manual is divided into four parts: fuels and combustion; heating and heating systems, including operative controls; installation and operation of oil burners; retail sales. The object is to provide a manual of theoretical and practical considerations entering into the manufacture, installation, and use of oil burners in moderate size heaters. A section of forms and tables is appended, accompanied by a thirty-page glossary of terms.

PRECISION HOLE LOCATION FOR INTERCHANGEABILITY IN TOOLMAKING AND PRODUCTION, INCLUDING WOODWORTH CIRCULAR TABLES:

J. R. Moore. Moore Special Tool Company, Bridgeport, Conn., 1946. 448 pp., illus., diagrs., charts, tables, 10¼ x 7 in., fabrikoid, U.S. $3.00, elsewhere $3.50.

This book contains a comprehensive review of hole-location practices and the development of engineered methods consistent with the principle of interchangeability. The three fundamental steps in hole location are defined, and the principles are analysed. With this background a typical die is carried through as illustration with emphasis on the likely errors which must be overcome. The precision jig borer and jig grinder produced by the author's company to accomplish the desired results are described with operational detail. A series of diagrams and tables covers the location of from 3 to 100 holes on circles of any diameter.

Although not available in the Institute Library, inquiries concerning the following new books will be welcomed there or may be sent direct to the publishers.

HEAT TREATMENT OF METALS, A SERIES OF EDUCATIONAL LECTURES PRESENTED TO MEMBERS OF THE LOS ANGELES CHAPTER OF THE SOCIETY:

E. Brocker and others. American Society for Metals, 7301 Euclid Ave., Cleveland, Ohio, 1946. 178 pp., illus., diagrs., charts, tables, 9¼ x 6 in., cloth, $3.00.

The series of ten lectures reprinted in this volume covers various aspects of the general subject, including induction heating, isothermal transformation in steel, two papers on the treatment of light metal alloys, and three on the theory and practical applications of hardenability. The first lecture briefly defines heat treating methods and gives examples of particular applications.

HEAVISIDE'S ELECTRIC CIRCUIT THEORY:

H. J. Josephs with foreword by W. G. Radley. Chemical Publishing Co., New York, 1946. 115 pp., diagrs., 7 x 4¼ in., cloth, $2.25.

The author bases electric circuit theory on a theorem, reconstructed from the scattered papers of Heaviside, from which the Carson integral equation may be derived. Beginning with a chapter on fundamentals of electric circuit theory, the author discusses the expansion theorem and Heaviside's "last theorem" and their relation to ladder networks and transmission lines, and devotes the final chapter to the application of modern theories of integration to the solution of circuit problems.

PIEZOELECTRICITY, AN INTRODUCTION TO THE THEORY AND APPLICATIONS OF ELECTROMECHANICAL PHENOMENA IN CRYSTALS:

W. G. Cady. McGraw-Hill Book Co., New York, Toronto, 1946. 806 pp., illus., diagrs., charts, tables, 9 x 5¾ in., cloth, $9.00.

The entire field of piezoelectricity is covered in this comprehensive treatise, including related areas of elasticity, dielectrics, optics and magnetism. Crystallography and the general properties of crystals lead up to the discussion of quartz and Rochelle salt with their special applications. A unified account is given of experimental results, with many formulas, numerical data, and an extensive bibliography.

PLASTICS HANDBOOK FOR PRODUCT ENGINEERS:

Compiled and edited by J. Sasso. McGraw-Hill Book Co., New York and London, Toronto, 1946. 468 pp., diagrs., charts, tables, 9 x 5¾ in., cloth, $6.00.

This handbook brings together practical and fundamental data on plastics and synthetic rubber for designers and engineers who want complete facts on the suitability of these materials in new product designs. The book contains specific information on all types of plastics and the properties of each; how to select the right type for a given application; processing, machining, and finishing plastic parts, and on design details such as tolerances, threads, fastening, etc. Valuable information is given on common faults, causes, and remedies in molded plastic parts. Synthetic rubbers are also covered, from both the chemical and engineering viewpoints.

RADIO'S CONQUEST OF SPACE, THE EXPERIMENTAL RISE IN RADIO COMMUNICATION:

D. McNicol. Murray Hill Books, New York and London, 1946. 374 pp., illus., diagrs., 8¾ x 5½ in., cloth, $4.00.

Beginning with a review of certain electrical inventions and developments that preceded radio, this book presents, in generally chronological order, a narrative of the experimental achievement by which radio has reached its present status. Along with the descriptions and discussions of technical developments, an account is given of the men who contributed to these developments and the manner in which these achievements were realized. The final chapter discusses the expanding sphere of radio.

SURVEYING:

H. Bouchard. 3 ed. International Textbook Co., Scranton, Pa., 1947. 647 pp., illus., diagrs., charts, tables, 8 x 5 in., fabrikoid, $4.50.

This standard textbook covers in the first seven chapters the fundamental operations of surveying, such as the measurement of angles, horizontal and vertical distances, and field operations with the transit. Subsequent chapters deal with triangulation, topographic and hydrographic surveys, municipal and other special surveys, errors, and astronomical observations. The adjustment of instruments is explained, and the new edition contains a discussion of the State systems of plane coordinates.

SYMPOSIUM ON MATERIALS FOR GAS TURBINES, 49TH ANNUAL MEETING, AMERICAN SOCIETY FOR TESTING MATERIALS, JUNE 24-28 1946:

American Society for Testing Materials, Philadelphia, Pa. 199 pp., illus., diagrs., charts, tables, 9 x 6 in., paper, $3.00. (A.S.T.M. members, $2.25).

The first five papers in this group deal directly with researches on the subject carried out over the last few years: heat-resisting metals for gas turbine parts; high-temperature alloys for aircraft turbosuperchargers and gas turbines; chromium-base alloys; metallurgy of high-temperature alloys used on current gas turbine designs; alloys and ceramic materials for high-temperature service. The succeeding three papers are of related interest and deal with the corrosion resistance of iron-nickel-chromium alloys, the compressive properties of aluminum alloy sheet, and the tensile and creep strengths of some magnesium-base alloys, all at elevated temperatures.

THORPE'S DICTIONARY OF APPLIED CHEMISTRY, VOL. 7, IODAZIDE—METALLAGIC ACID, WITH AN INDEX BY J. N. GOLDSMITH. 4TH ED. REV. & ENL.

Longmans, Green and Co., London, New York, Toronto, 1946. 629 pp., illus., diagrs., charts, tables, 9¼ x 6 in., cloth, $30.00

Continuing the revision of this standard reference set, this volume, like the preceding ones, presents extensive, authoritative treatments of chemical substances, reactions, principles and processes as related to their application in industry. Extensively documented, the volumes are not only valuable sources of information in themselves, but also serve as guides to a tremendous amount of chemical and chemical engineering literature. Topics in this volume range from iodoform and isomerism to leather tanning and match manufacture.

TRANSPORTATION MANAGEMENT:

H. B. Cooley. Cornell Maritime Press, New York, 1946. 183 pp., 9¼ x 6 in., cloth, $5.00.

Air, water and truck transportation are covered with special emphasis on the traffic, operating, treasurer's, and comptroller's departments. Subsequent chapters deal with personnel relations, wage systems and incentives, budgeting, purchasing and stores, standard costs, and report preparation. The book presents general principles to be considered in analyzing or planning an organization, with no attempt to give detailed information on operational procedures.

WORK MEASUREMENT MANUAL:

R. M. Barnes. 3 ed. Wm. C. Brown Company, Publishers, Dubuque, Iowa, 1947. 218 pp., illus., diagrs., charts, tables, 11 x 8½ in., paper, $3.75.

This manual describes in detail how an organization may proceed to check the ability of its time study men to set standards and to improve their accuracy and consistency. It also explains how these standards may be compared with national standards being developed by the author. Some general information on time study work precedes the main section, and subsequent sections contain suggestions for community time study surveys and for the development and use of standard data. The book also contains the results of an industrial engineering survey of eighty companies, including time study and related clauses from union contracts.

HAVE YOU RETURNED THE CARD?

The 70% response which experts claim is very good for business reply cards will not be good enough to give you an accurate membership list. If you have not yet returned the card received with last month's *Journal*,

PLEASE DO SO NOW.

Employment Service

The service is operated for the benefit of members of The Engineering Institute of Canada, and for industrial and other organizations employing technically trained men—without charge to either party. It would therefore be particularly appreciated if employers would make the fullest possible use of these facilities to make known their existing or estimated requirements. Notices appearing in the Situations Wanted column will be discontinued after three insertions, and will be re-inserted upon request after a lapse of one month. Personal interviews by appointment.

Situations Vacant

CHEMICAL

CHEMIST, recent graduate, required by manufacturer in central Ontario as shift chemist in Analytical Laboratory. Training emphasis on Organic-Physical and Inorganic Chemistry. Starting salary $225. Apply to File No. 3911-V.

CHEMICAL ENGINEER with considerable mechanic and hydraulic experience or mechanical engineer with good chemical knowledge and experience in hydraulics, required by a manufacturer in Ontario. Salary open. Apply to File No. 3928-V.

CIVIL

CIVIL ENGINEER, required in New Brunswick. Must be qualified designer of miscellaneous public utility buildings in frame and masonry construction. Thorough working knowledge of timber, reinforced concrete and steel framing essential, knowledge of the design of various types of heating systems and plumbing. Salary open. Apply to File No. 3887-V.

CIVIL OR STRUCTURAL ENGINEER, 24-35 years required for Northern Ontario Paper mill. At least 2 years construction and 2 years design experience. Opportunity to train junior personnel. Salary not less than $350. Apply to File No. 3891-V.

CIVIL ENGINEER required as Town Engineer of a town in the Maritimes. Required to supervise and layout work for Water and Sewarage department. works department also construction of a general nature for the Electric Light department. Salary open. Apply to File No. 3930-V.

CIVIL ENGINEER required by a Steel Company in Montreal for the design of reinforced concrete frame. Salary open. Apply to File No. 3931-V.

ELECTRICAL

ELECTRICAL ENGINEER required as Assistant Superintendent, Light and Power Department, Saskatchewan City. Must have several years experience in Utility Field. Minimum starting salary $3,600. Apply to File No. 3913-V.

ELECTRICAL ENGINEER, required for sales engineering work in Western Canada. Graduates with some selling experience preferred. Salary open, plus expenses. Apply to File No. 3915-V.

ELECTRICAL ENGINEER, recent graduate, required in Montreal for general engineering on telephone and radio. Salary $175 to $225. Apply to File No. 3923-V.

MECHANICAL

MECHANICAL ENGINEER, age 30-38, required for northern Ontario Paper Mill. Preferably with paper mill experience or experience in general layout and design. Knowledge of pumps capacities, piping, conveyors, estimating and structural design essential. Salary open. Apply to File No. 3891-V.

MECHANICAL ENGINEER, age 25 to 35, experienced in industrial plant layout and machine design required by a manufacturing firm in Brantford. Salary open. Apply to File No. 3907-V.

MECHANICAL ENGINEER, recent graduate, required in the engineering department of a transportation company in Ontario. Duties include Bus Maintenance. Salary open. Apply to File No. 3909-V.

MISCELLANEOUS

SALES ENGINEER with mechanical background, willing to study and work on specialized equipment needed in every industry. Reply giving fullest information re present employment, training, age and salary expected. Apply to File No. 3861-V.

STRUCTURAL STEEL CHECKER AND ONE DETAILER CHECKER wanted for large fabricating plant in Vancouver, B.C. Age between 30 and 40 years preferred. Must be experienced. Give full information and references. Salary open. Apply to File No. 3862-V.

INDUSTRIAL ENGINEERS, preferably with mechanical background, required as Management Superintendents by a firm of industrial consultants in Montreal. Experience in time study, cost control etc. Salary $300-$400. Apply to File No. 3910-V.

CIVIL OR MECHANICAL ENGINEER, interested in the sales and engineering of power transmissions, gravity conveyors and grain separators required in Western Canada. Salary open. Apply to File No. 3915-V.

GRADUATE ENGINEER OR PHYSICIST, bilingual, preferably with knowledge of X-Rays required by Canadian office of worldwide electronic concern to manage X-Ray application engineering activities. Salary $2,700 to $3,600, or more depending on qualifications. Apply to File No. 3917-V.

JUNIOR ENGINEER with some structural experience required by large milling company with headquarters in Toronto for design work on flour and feed mill buildings and equipment. Salary open. Apply to File No. 3918-V.

MECHANICAL or ELECTRICAL ENGINEER required in French Guinea by an industrial organization for foreman work in connection with open pit mining and shipping of bauxite with possibility of taking over Superintendent work. Must be bilingual. Salary $250-$300. Apply to File No. 3920-V.

MINING or CIVIL ENGINEER required in French Guinea by an industrial organization to look after open pit beauxite mining and construction work with possibility of being placed in plant superintendent position. Must be bilingual. Salary $350-$400. Apply to File No. 3920-V.

EXPERIENCED SALES ENGINEERS who are visiting metal and woodworking factories, general building contractors etc. in Quebec, Montreal, Three Rivers and Sherbrooke, who would be willing to take on several lines of a Toronto firm on commission basis. Apply to File No. 3922-V.

JUNIOR ENGINEER preferably with some practical machine shop or mechanical, electrical or automotive maintenance experience required in Montreal as assistant to Supt. of Equipment on testing, investigation, and designing in connection with the repair and maintenance of Car Trolley Coach and Bus Rolling Stock units and equipment. Salary open. Apply to File No. 3925-V.

AERONAUTICAL ENGINEER, required in Montreal, with 5 years experience in aircraft industry of which 3 years should have been in aerodynamics work and 2 years in advanced flight test reduction or performance analysis. Salary open. Apply to File No. 3926-V.

GRADUATE ENGINEER from a recognized University, preferably in the field of Applied Science, with a few years of industrial experience and fluently bilingual; possession or ability to obtain an automobile for transportation essential. Required in Montreal. Salary open. Apply to File No. 3927-V.

AERONAUTICAL OR MECHANICAL ENGINEER required for service engineering work on aircraft, engine and accessory overhaul in Winnipeg by large aircraft operator. At least 2 or 3 years of Air-Force, air-line or aircraft manufacturing experience required. Salary $200 to $300, depending on experience. Apply to File No. 3929-V.

GRADUATE ENGINEER, MECHANICAL ELECTRICAL or CIVIL, about 30 years of age, required by a large Hydro-Electric Utility in Montreal for Field Testing Hydraulic Turbines. Salary open. Apply to File No. 3932-V.

The following advertisements are reprinted from last month's Journal, having not yet been filled.

CHEMICAL

CHEMICAL ENGINEER OR CHEMIST, preferably with Ph.D., required by a pulp and paper company with plants in Eastern Canada, for research work. Salary open. Apply to File No. 3549-V.

CHEMICAL ENGINEER required by a pulp and paper company with plants in Eastern Canada, for mill control and pilot plant work. Salary open. Apply to File No. 3549-V.

CHEMICAL ENGINEER to be assigned to mill process problems for the technical department of a pulp and paper firm in the St. Maurice Valley. Salary $250. up. Apply to File No. 3573-V.

CHEMICAL ENGINEER required as assistant professor of chemical engineering in a Canadian university to start autumn 1947. Salary open. Apply to File No. 3600-V (D)

CHEMICAL OR METALLURGICAL ENGINEERS, from recent graduates up, required by a Quebec firm engaged in metal production for employment as production and development engineers. Salaries open. Apply to File No. 3693-V.

CHEMICAL ENGINEER, required by a chemical firm in Shawinigan Falls, Quebec, for development work on plastics. Salary open. Apply to File No. 3812-V.

CHEMICAL METALLURGIST with background in extraction metallurgy and ore dressing (knowledge of minerogy desirable) and experience in use of petrographic microscope. Required for research work in B.C. Maximum Salary $4,000. Apply to File No. 3865-V.

CIVIL

CIVIL ENGINEER to take charge of work in a drainage district in Quebec Must be bilingual. May be recent graduate. Salary from $200. Apply to File No. 3479-V.

CIVIL ENGINEER for design work in an industrial plant in the Montreal area with experience in building construction, probably permanent position, salary from $200 up according to experience. Apply File No. 3504-V.

CIVIL ENGINEERS with experience in detailing and designing structural steel and reinforced concrete for manufacturers are required for a steel fabricating company in Manitoba. Salary open. Apply File No. 3519-V.

CIVIL ENGINEERS, recent graduate up, required by a pulp and paper company with plants in Eastern Canada. Salary open. Apply to File No. 3549-V.

CIVIL ENGINEER, age 35-40, with extensive experience in detailing and checking structural steel in buildings and bridges, required by a steel fabricating company in Southern Ontario. Salary open. Apply to File No. 3570-V.

GRADUATE CIVIL ENGINEER, required by a public utility in the Montreal area with three or four years' experience in design of reinforced concrete and structural steel. Salary $250-$300. Apply to File No. 3766-V.

GRADUATE CIVIL ENGINEER required by an industrial corporation in Montreal for design work in draughting room. Must be familiar with structural steel and concrete design. Position offers good opportunity and permanency to right man. Salary from $250 up according to experience. Apply to File No. 3785-V.

SEVERAL CIVIL ENGINEERS, with two or three years' experience in road construction required for road building work in Northern Quebec. Salary open. Apply to File No. 3804-V.

CIVIL ENGINEERS with some experience in design and field work required by a public utility in Toronto. Salary open. Apply to File No. 3813-V.

CIVIL ENGINEER, age 35-40, with considerable experience in design of structures, water supply, sewers, required by an organization in Montreal. Salary $300-$400. Apply to File No. 3820-V.

CIVIL ENGINEER with building construction experience required by a manufacturer in Montreal. Salary $250 up. Apply to File No. 3858-V.

CIVIL ENGINEERS AND DRAUGHTSMEN required by an industrial organization for design and detailing of reinforced concrete for Hydro Electric developments. Location Montreal. Salary open. Apply to File No. 3864-V.

CIVIL ENGINEER, recent graduate, must be bilingual, required for public utility in Quebec City. Salary open. Apply to File No. 3878-V.

CIVIL ENGINEER required as Manager for City of Ste. Therese, Que. Salary open. Apply to File No. 3881-V.

CIVIL ENGINEERS required as draughtsman in bridge department of large transport company. Preferably with experience in steel ,concrete and timber construction. Location Montreal. Salary $200-300. Apply to File No. 3884-V

CIVIL ENGINEERS required in Montreal for design of reinforced concrete Must be experienced. Salary $300-$400. Apply to File No. 3892-V.

CIVIL ENGINEER required by a firm in the St. Maurice Valley, to be in charge of improvements in woods operations such as dams, bridges, roads. etc. Must be bilingual. Salary $350. Apply to File No. 3902-V.

ELECTRICAL

ELECTRICAL ENGINEER, age 32-36, with electrical experience around mines or smelters. English speaking with working knowledge of French, is required by a company in Shawinigan Falls, Quebec. Salary open. Apply to File No. 3415-V.

ELECTRICAL ENGINEER age 30-45 with sales training with large manufacturer of electrical equipment instruments and 5-10 years experience as sales service and sales engineer required as sales engineer in Canada for U.S. firm making special equipment for transport and industry. Salary open. Apply to File No. 3447-V.

ELECTRICAL ENGINEER, recent graduate, required for the engineering staff of a paper mill in the Lake St. John area. Salary open. Apply to File No. 3507-V.

INSTRUCTOR IN ELECTRICAL ENGINEERING required for supervision of laboratory classes in power laboratory also few lectures per week, in direct current theory for Canadian University. Salary open. Apply to File No. 3600-V (G).

ELECTRICAL ENGINEER with knowledge of power apparatus, preferably bilingual, required for sales work with a manufacturer in the Montreal area. Salary open. Apply to File No. 3646-V.

ELECTRICAL ENGINEER with considerable industrial experience required as a safety engineer by a public utility in the Montreal area. Bilingual preferred. Salary open. Apply to File No. 3654-V.

ELECTRICAL ENGINEER with several years experience required as a designer by an industrial organization in Montreal. Salary open. Apply to File No. 3677-V.

ELECTRICAL ENGINEER, with general knowledge of a.c. and d.c. motors, switchgear, mercury rectifiers, transformers and other electrical apparatus, for sales work in Eastern Canada, age 30 to 35, salary open. Apply to File No. 3695-V.

ELECTRICAL DRAUGHTSMEN with several years' experience in industrial layouts for large concern in Eastern Townships. Permanent position and attractive salary available for experienced men. Apply to File No. 3701-V.

ELECTRICAL ENGINEER, age about 30, with considerable experience, required by a manufacturer in the St. Maurice Valley. Salary open. Apply to File No. 3723-V.

ELECTRICAL ENGINEER, required by an insurance company, preferably with a few years practical experience, for the inspection of boilers, steam plant and allied equipment in Montreal area. Salary open. Apply to File No. 3754-V.

ELECTRICAL ENGINEER, recent graduate up, required by a manufacturer in Montreal, for sales engineering. Preferably bilingual and familiar with rotating electrical equipment. Salary $200. up. Apply to File No. 3761-V.

GRADUATE ELECTRICAL ENGINEERS with 3 to 10 years experience in design, operation, layout of substations, switching stations, and electrical machinery, together with engineering studies, including draughting for a large hydro electric power house in Quebec. Salary $225 up. Apply to File No. 3787-V.

ELECTRICAL ENGINEER required for power sales by an electrical utility in Province of Quebec. Preferably experienced. Bilingual. Salary open. Apply to File No. 3802-V.

ELECTRICAL ENGINEER with experience in layout and design of generating and transformer stations, required by a public utility in Toronto. Salary open. Apply to File No. 3813-V.

JUNIOR ELECTRICAL ENGINEER required by a Montreal firm for inspection of electrical equipment of all kinds, in Toronto area. Salary $225. Apply to File No. 3816-V.

ELECTRICAL ENGINEER under 30, required as sales engineer of switchgear, electrical and power-house equipment, by a manufacturer in Montreal. Considerable travelling. Salary $4,000. plus expenses. Apply to File No. 3885-V.

SEVERAL EXPERIENCED ELECTRICAL DRAUGHTSMEN for the design and layout of industrial power and control system, required by consulting engineering office in Montreal. Salary open. Good chance for advancement. Apply to File No. 3890-V.

GRADUATE ELECTRICAL ENGINEER, 3 to 5 years, experience, preferably in industrial electric power applications and electric control, required by consulting engineering office in Montreal, to act as assistant to the electrical engineer on design of a large industrial project.. Salary open Apply to File No. 3890-V.

JUNIOR ELECTRICAL ENGINEER, required as assistant to Plant Manager of a textile manufacturing concern near Montreal. Salary $250 to $300. Apply to File No. 3903-V.

JUNIOR ELECTRICAL ENGINEER with practical experience in general manufacturing industries required by an industrial organization in Ontario. Salary open. Apply to File No. 3904-V.

ELECTRICAL ENGINEER, recent graduate, required by an industrial organization in Montreal. Salary $200 up. Apply to File No. 3905-V.

ELECTRICAL ENGINEER, recent graduate, required by a paper company for work in mill equipment and power generators. Salary $225. Apply to File No. 3906-V.

MECHANICAL

MECHANICAL ENGINEER, is required for draughting and detail work with a company in central Ontario. Good prospects for advancement. Single man preferred. Salary open. Apply to File No. 3393-V.

MECHANICAL ENGINEERS, preferably with design experience, are required for armament research and development in the Quebec area, in a government establishment. Salary from $190. Apply to File No. 3401-V.

MECHANICAL ENGINEER with experience in pulp and paper or mining work required by a pulp and paper company with plants in Eastern Canada. Salary open. Apply to File No. 3549-V.

GRADUATE MECHANICAL ENGINEERS for Sessional appointment as Instructors for 8 months from 1st September, 1947, and Demonstrators for 7 months from 1st October, 1947, required by McGill University. Apply giving qualifications and salary required to File No. 3600-V (I).

MECHANICAL ENGINEER with experience in the fabrication of Farm Implements, required by a Quebec firm. Bilingual man preferred. Salary according to experience. Apply to File No. 3666-V.

MECHANICAL ENGINEER with design experience in the pulp and paper industry required by a firm in the St. Maurice Valley. Salary $350. Apply to File No. 3673-V.

JUNIOR MECHANICAL ENGINEER with knowledge of precision machine shop practice and aptitude for research work in metals and plastics required for an organization in Toronto for the production of artificial limbs. Must be veteran. Salary from $225. Apply to File No. 3675-V.

MECHANICAL ENGINEER with industrial or construction experience, required by a firm of consulting engineers to inspect machinery deliveries in the Cornwall area. Salary open. Apply to File No. 3691-V.

MECHANICAL ENGINEERS, with at least five years' experience in the Pulp and Paper industry required by an Ontario Paper Company. Salary open. Apply to File No. 3733-V.

MECHANICAL ENGINEER with experience in heating, ventilating and air-conditioning, required by a consulting engineer in Montreal. Salary open. Apply to File No. 3773-V.

MECHANICAL ENGINEER with considerable experience willing to act as assistant to Mechanical Superintendent of a textile manufacturing concern near Montreal. Salary open. Apply to File No. 3784-V.

MECHANICAL ENGINEERS required by a Pulp and Paper mill at Powell River, B.C. Preferably with experience in plant design in the pulp and paper industry. Salary according to qualifications. Apply to File No. 3796-V.

MECHANICAL DRAUGHTSMAN, with several years experience in machine design, required by an industrial organization in Montreal. Salary $250 up. Apply to File No. 3807-V.

MECHANICAL ENGINEER with at least 10 years experience in design and installation of machinery also supervisory ability required by an industrial organization in Montreal, Salary open. Apply to File No. 3807-V.

MECHANICAL ENGINEERS, with experience in plant layout and design or ventilation problems or general mechanical design, required by a firm in Quebec. Salary from $250. Apply to File No. 3818-V.

MECHANICAL ENGINEER, age 35-40, with considerable experience in design and layout of machinery and equipment, required by an organization in Montreal. Salary $300-$400. Apply to File No. 3820-V.

MECHANICAL ENGINEERS, preferably with experience in machine design, required by a steel fabricating firm in Montreal for design and layout. Salary open. Apply to File No. 3824-V.

MECHANICAL ENGINEER with considerable experience, required to supervise installation of coating machine also design necessary. tankage and piping systems, for a paper mill in Ontario. Salary around $400. Apply to File No. 3828-V.

MECHANICAL ENGINEERS, required by a pulp and paper mill in Ontario for design and layout also mechanical installations. Salary around $300. Apply to File No. 3828-V.

MECHANICAL ENGINEER, required by a manufacturer in Ontario for the plant operation staff. Salary open. Apply to File No. 3833-V.

MECHANICAL ENGINEER with six to ten years experience in maintenance and engineering work, required by alkali manufacturers in Ontario. Salary open. Apply to File No. 3833-V.

MECHANICAL ENGINEER, recent graduate up, veteran preferred must be bilingual. Required to under study Manager and eventually take charge of four plants at St. John. Salary around $200 to start. Apply to File No. 3842-V.

MECHANICAL ENGINEER, recent graduate up, required by a company in Montreal for toll design. Salary $175 up. Apply to File No. 3843-V.

MECHANICAL ENGINEER recent graduate, preferably with some practical experience in manufacturing, required by a Farm Equipment manufacturer in Ontario. Starting salary $225. Apply to File No. 3851-V.

MECHANICAL ENGINEER, preferably with experience in heating and ventilating problems required in Montreal for design and investigation. Salary $250 up. Apply to File No. 3858-V.

MECHANICAL ENGINEER, with knowledge of physical metallurgy heat treatment, ability in stress analysis and design. Required for research work in B.C. Maximum salary $4,000. Apply to File No. 3865-V.

MECHANICAL ENGINEER, recent graduate, required by a Montreal wall-paper manufacturer to be trained as mechanical superintendent. Salary $200. Apply to File No. 3876-V.

MECHANICAL ENGINEER, bilingual, with 4 or 5 years experience in sheet metal work, required as Plant Manager by a manufacturer in the Province of Quebec. Salary open. Apply to File No. 3894-V.

MECHANICAL ENGINEER required by a firm of Power House and Building Specialists to act as representative in the Toronto Territory. Must be familiar with that district. Preferably manufacturers' agent to act as sub-agent. Salary open. Apply to File No. 3897-V.

MECHANICAL DRAUGHTSMAN with at least 5 years' experience or graduate just out of college, to act as draughtsman on industrial work. Salary above $200. Group insurance plan. Apply to File No. 3899-V.

GRADUATE MECHANICAL ENGINEER, 3 years, experience, preferably in industrial layout, required by consulting engineering office in Montreal to serve as junior engineer on design of industrial project. Salary about $250. Group insurance plan. Apply to File No. 3899-V.

RECENT GRADUATE, mechanical background, required by a manufacturer in Montreal for duties leading to production. Salary $225. Apply to File No. 3901-V.

MINING

MINING ENGINEERS, with varied experience required by a firm in Quebec for general mine operation, exploitation and development work. Salary from $250. Apply to File No. 3818-V.

MISCELLANEOUS

MANAGEMENT ENGINEER with business administration and mechanical background, age 30 up, bilingual with at least 5 years practical experience, required by an industrial engineering consultant in Montreal. Apply to File No. 3307-V.

STRUCTURAL STEEL DRAUGHTSMEN AND CHECKERS, preferably graduate engineers but any experienced men acceptable, are required for a steel fabricating company in Manitoba. Salary open. Apply to File No. 3519-V.

ASSISTANT PLANT ENGINEER with paper mill experience required by a pulp and paper company with plants in Eastern Canada. Salary open. Apply to File No. 3549-V.

GRADUATE ENGINEERS, required by a large industrial and chemical organization with headquarters in Montreal for all phases of research design, operation, development, production and maintenance. Salaries open. Apply to File No. 3588-V.

CHIEF ENGINEER with industrial experience required for a steel fabricating plant in Western Canada. Salary open. Apply to File No. 3616-V.

DESIGN DRAUGHTSMAN for the design of cranes and hoists of all types, capable of making and checking complete manufacturing detail drawing, required by a manufacturer in Southern Ontario. Apply to File No. 3628-V by letter with full details. Salary open.

SALES ENGINEER with wide engineering experience wanted by a company in Toronto for the sale of textile machinery and construction equipment. Salary open. Apply to File No. 3639-V.

STRUCTURAL DESIGNERS AND DRAUGHTSMEN required by a firm of consulting engineers in Montreal. Salary open. Apply to File No. 3668-V.

JUNIOR ENGINEERS, recent graduates up, as designing draughtsmen for a brewing company with headquarters in Montreal. Salary from $200. Apply to File No. 3670-V.

MINING AND METALLURGICAL ENGINEER, age about 30, with considerable experience, required by a manufacturer in the St. Maurice Valley. Salary open. Apply to File No. 3723-V.

CIVIL ENGINEERS AND ASSISTANT HYDRAULIC ENGINEERS required for government organization on West Coast for highway and construction. Salary open. Apply to File No. 3724-V.

CONSTRUCTION ENGINEER with considerable experience required for the permanent staff of a Montreal inspection company. Salary about $200. Age immaterial. Apply to File No. 3728-V

DETAILER AND DESIGNER for reinforcing steel with considerable experience required by a steel fabricating firm in Montreal. Salary open. Apply to File No. 3740-V.

STRUCTURAL STEEL DETAILER AND CHECKER with considerable experience required for checking shop details by a steel fabricating firm in Montreal. Salary open. Apply to File No. 3740-V.

GRADUATE ENGINEERS, recent graduates up, preferably mechanical, required for the engineering and operating staff of a pulp mill in Eastern Quebec. Salary open. Apply to File No. 3748-V.

PUBLICITY ENGINEER required by an electrical firm in Montreal to organize publicity department and edit trade journal. Salary open. Apply to File No. 3751-V.

TECHNICAL GRADUATE, preferably Mechanical, Chemica or Electrical, under 30, veteran preferred, for permanent position with engineering organization. Training period in U.S. Work will include travelling for consultation among leading industrial plants. Enclose photo when answering. Salary open. Apply to File No. 3759-V.

CIVIL, MECHANICAL OR CHEMICAL ENGINEERS, recent graduates up, preferably with experience in petroleum and heavy industry such as chemical or paper, required by an oil company in Toronto. Salary open. Apply to File No. 3762-V.

BRIDGE ENGINEER, qualified to be in charge of the design and supervision of the construction of highway bridges. Apply stating qualifications, experience, age and salary wanted to File No. 3780-V.

GRADUATE CIVIL OR MECHANICAL ENGINEERS with 3 to 10 years experience in design, cost estimates, draughting, and engineering studies for a large hydro-electric power house in Quebec. Salary $225 up. Apply to File No. 3787-V.

STEAM PLANT ENGINEER for large concern in Eastern Townships, with at least 5 years practical experience. Must be familiar with thermo-dynamics, combustion control, steam turbines, mechanical refrigeration, hydraulics, etc. Permanent position and attractive salary for the right man. Apply to File No. 3791-V.

RECENT GRADUATES OR JUNIOR ENGINEERS with mechanical background, required by a Montreal Engineering, fabricating and contracting firm for training purposes leading to sales and service. Area Montreal. Salary $175 up. Apply to File No. 3810-V.

STRUCTURAL ENGINEER, required by a firm of consulting engineers in Montreal for design work. Must have experience in structural steel and reinforced concrete. Salary open. Apply to File No. 3811-V.

INDUSTRIAL ENGINEER with broad experience in plant development, operation, costs and management required for a firm in Quebec. Salary from $250. Apply to File No. 3818-V.

GRADUATE ENGINEER, preferably with chemical and industrial experience, required to supervise operations at the Sodium Sulphate Plant now being constructed at Chaplin, Sask. Salary open. Apply to File No. 3821-V.

DRAUGHTSMEN required by a pulp and paper mill in the Eastern Townships for general draughting and detailing. Three or four years experience preferred but not essential. Salary open. Apply to File No. 3823-V.

DRAUGHTSMAN, preferably with mechanical background, required by a manufacturer in Montreal for design work on electrical equipment. Salary open. Apply to File No. 3829-V.

DEPUTY DIRECTOR OF IRRIGATION, Ceylon, must be Corporate Member of the Institute of Civil Engineers or possess degrees or diplomas recognized by that body. Technical duties include designing, estimating for and reporting on schemes of irrigation water supply and flood protection and checking the construction costs of such schemes. Apply to File No. 3834-V.

GRADUATE ENGINEER, age 35-40, with 10 years experience in building construction and general contracting work; to supervise design, construction and maintenance of structures for Public Utility in Toronto. Permanent job. Salary open. Send photo and full particulars of education and experience. Apply to File No. 3847-V.

JUNIOR INDUSTRIAL ENGINEER, with mechanical or chemical background, preferably with knowledge of chemical plants, required in Montreal. Salary $250 up. Apply to File No. 3857-V.

DRAUGHTSMEN of the following classes: Architectural, piping layout, equipment layout, mechanical design, steam plant, heating, and ventilating, electrical and plumbing required by an industrial organization in Montreal. Salaries open. Apply to File No. 3860-V.

MECHANICAL, CHEMICAL OR CIVIL, recent graduate up, required for sales and service in Alberta by a Montreal manufacturer. Salary open. Apply to File No. 3867-V.

SALES ENGINEER, preferably with mining or mechanical background, practical experience in heavy machinery industry, shovels, cranes, etc., required by an Asbestos company in Montreal. Salary $275-$325. Apply to File No. 3870-V.

CIVIL OR MINING ENGINEER, with executive ability, required by a construction firm in Quebec to supervise highway construction. Must be bilingual. Permanent position. Salary $300-500. Apply to File No. 3877-V.

MECHANICAL OR CHEMICAL ENGINEER, recent graduate, required by a firm in Montreal. Ability to do simple drawings, such as layout of piping and instruments. Some experience in oil refinery or chemical plant or pulp and paper would be useful. Position to eventually lead to sales. Salary $200. Apply to File No. 3879-V.

GRADUATE ENGINEERS, required for all phases of research design, operation and development by an industrial organization in Montreal. Salaries open. Apply to File No. 3882-V.

SALES ENGINEERS, required by established Canadian manufacturer of fabricated steel products. Some construction experience an advantage. Wanted for Maritimes, Ontario and Manitoba. Salary open. Apply to File No. 3883-V.

GRADUATE ENGINEER, familiar with industrial processes, metallurgical and chemical engineering as applied to steel, copper, mining and chemical plants. Broad general experience in estimating and designing. Salary open. Toronto area. Apply to File No. 3886-V.

SALES ENGINEER, with electrical engineering background required by an old established firm in Western Ontario for the sale of industrial furnaces and ovens. Splendid opportunity with rapid advancement. Reply giving age and complete details of past experience. Salary open. Apply to File No. 3888-V.

INDUSTRIAL ENGINEER, preferably with mechanical background and several years' experience in time-studies, estimating, etc., required by a manufacturer in Montreal. Salary $250. up according to experience. Apply to File No. 3893-V.

INDUSTRIAL ENGINEER, preferably mechanical or electrical background, required in a factory in Montreal for time-study, cost control, etc. Salary $300. up. Apply to File No. 3895-V.

STRUCTURAL ENGINEER, preferably a graduate civil engineer, with experience in the design of mill buildings, required by a paper manufacturer in Eastern Ontario. Salary open. Apply to File No. 3896-V.

SALES ENGINEER, mechanical background, preferably with experience in the refrigeration field, required by a Montreal firm. Salary $250-$300. Considerable travelling. Apply to File No. 3898-V.

WELL-ESTABLISHED FIRM of consulting engineers in Montreal offers position with possibilities to self-reliant man capable of designing and checking all kinds of reinforced concrete and structural steel. Hydro-electric experience an advantage. Must be experienced draughtsman. Pay commensurate with ability. Group insurance plan. Apply to File No. 3899-V.

RECENT GRADUATES, required by an industrial organization in Montreal for training in Purchasing department. Salary $200 up. Apply to File No. 3900-V.

RECENT GRADUATES in Electrical or Mechanical Engineering can still be offered the opportunity of being trained by large Hydro Electric Utility. Very good opportunities for regular employment in various departments at the completion of training period. Minimum salary 1st year $200; 2nd year $215. Apply to File No. 3912-V.

THE LONGLAC PULP AND PAPER COMPANY

will receive applications for the following positions for the 300-ton sulphate pulp mill now being built at Terrace Bay, Ontario. Applications are to be made in writing to the Company at Terrace Bay. Salaries open and will depend on training and experience.

TECHNICAL SUPERINTENDENT. To administer the Technical Department.

Requires a minimum of five years in technical or production work in the pulp and paper industry. Educational requirement bachelor's degree in Chemical Engineering, Chemistry or similar technical field.

CONTROL ENGINEER. Primary duties to undertake the solution of manufacturing and technical control problems, etc. Preferably experience in pulp and paper industry. Educational requirement degree in Chemical Engineering or similar technical field.

INSTRUMENT ENGINEER. Primary duties to secure continuous optimum performance from all process instruments, maintenance of instruments, etc. Educational requirements degree in Mechanical or Chemical Engineering or similar technical field.

TECHNICAL FOREMAN. To develop, install and directly supervise the operation of technical control systems for raw material, inspection, process control, quality reporting, inventory, measurement and product satisfaction. Educational requirements Degree in Chemistry or Chemical Engineering or equivalent with a minimum of three years experience in technical control work in pulp and paper industry.

Assistant Superintendent

Wanted for Light and Power Department, City of Regina. Must be a graduate in Electrical Engineering with several years experience in the Utility Field. Some experience in steam plant operation would be an advantage but is not essential. This is a good opening for an engineer who wants to improve his knowledge of the Utility Field as the plant is at present undergoing a large expansion program. Minimum starting salary, $3,600.00 a year. Please address all replies to the Superintendent, Light and Power Department, Regina.

THE PUBLIC SERVICE OF CANADA

Requires

ORGANIC AND PHYSICAL CHEMISTS—
$4,200-$4,800 and $3,600-$4,200

and ENGINEERS—$3,600-$4,200 and $3,000-$3,600

Department of Mines and Resources, Ottawa

Full particulars on posters in Post Offices, National Employment Service Offices, or Offices of the Civil Service Commission throughout Canada. Application forms, obtainable thereat, should be filed immediately with the

CIVIL SERVICE COMMISSION OF CANADA
OTTAWA

Situations Wanted

GRADUATE HIGHWAY TRAFFIC AND TRANSPORTATION (Yale) and CIVIL ENGINEER (U.N.B.), Jr. E.I.C., age 26, married, several years experience, primarily in highways. Is interested and trained for traffic engineering positions in the following departments—police, city planning, city engineering, provincial highways; also in consulting engineering, transit and transportation companies, and Safety work with Safety and Insurance Organizations. Apply to File No. 184-W.

CIVIL ENGINEER, P.Eng. (Ont.), M.E.I.C., Diploma in Civil Engineering, University of Toronto, would like spare time work at design of structural steel or reinforced concrete on a fee basis. Would also consider checking structural steel details or estimating. At present employed in Niagara District. Apply to File No. 613-W.

GRADUATE CIVIL ENGINEER, S.E.I.C., P.Eng.(Que.), B.Sc. Queen's with some experience would accept part time work during evenings or week ends, at home preferably, on reinforced concrete and steel construction design problems, including preliminary or detailed plans. Presently employed and residing in Montreal area. Apply to File No. 1487-W.

MECHANICAL ENGINEER, B.Sc., M.E.I.C., P. Eng. (Que.), Queen's 1936, age 32, married; has 11 years of diversified and intensified experience to offer; including design, construction, maintenance, production, supervision, and management, in industry utilizing heavy machinery; wishes to contact companies re-openings in sales, production, or management leading to executive responsibility. Apply to File No. 2006-W.

GRADUATE ELECTRICAL ENGINEER (1939) M.E.I.C., M.I.R.E. Six years' experience in maintenance and installation of Naval Radar and Radio equipment including three years administration and supervision of large staff (both civilian and Naval personnel) engaged in such work; also two years, miscellaneous industrial experience including one year as Junior Engineer at Oil Refinery; Licensed Radio Amateur since 1932; Age 30, married, one child; interested in engineering, sales or district representative position particularly in Maritime Provinces or Newfoundland. Apply to File No. 2427-W.

MECHANICAL ENGINEER, M.E.I.C., 44 years, married, nineteen years. industrial experience, steel and iron foundries, machine shop, chief draughtsman, machine design, plant layout, cost estimating, job evaluation, time study, production supervision, work layout, foreman training, excellent in labour relations, sales representation, customer contact. Apply to File No. 2555-W.

HYDRAULIC ENGINEER, B.Sc., M.E.I.C., 20 years experience in Hydraulics relative to hydro-electric power development, hydraulic machinery design and manufacture and development in hydraulic turbine design. Experience in handling men. Desires change in position. Apply to File No. 2638-W.

MECHANICAL ENGINEER, Jr.E.I.C., P.E.Q., B.Sc. Age 32, married. Presently engaged in Montreal area, would prefer position in Eastern Ontario. Experience includes machine design, jig tool and die design, methods engineering, design development plant layout, engineering department organization. 4½ years as Chief Engineer. Also experience in construction industry on building, mechanical and electrical trades. Salary $425.00 per month. Available one month's notice. Apply to File No. 2682-W.

ELECTRICAL-MECHANICAL ENGINEER, Jr. E.I.C., age 30, graduate of Naval Electrical Engineering Officers course at Nova Scotia Technical College, 1945. Graduate of Naval Electrical Artificer's course at University of Alberta, followed by 6 months of instructional work on same. One year at sea as Chief Electrical Artificer on frigate in charge of all electrical equipment. Completed apprenticeship as machinist in railway repair shops in design work testing, research and calculations. Available on two weeks notice. Apply to File No. 2693-W.

ELECTRICAL ENGINEER, B. Eng. Honors, McGill 1943, Jr. E.I.C., A.I.R.E., Prof. Eng. (Que), 26, married, presently employed, desires change to smaller organization with more general scope, broader future responsible outlook, in Ontario or B.C. Experience in heavy manufacturing, radio production, standardization, specifications, audio design. Apply to File No. 2727-W.

YOUNG MECHANICAL ENGINEER, B.A.Sc., Toronto, S.E.I.C., single, now engaged in product design and development with firm in the Maritimes would prefer similar work in Southern Ontario requiring more technical and also more artistic ability. Apply to File No. 2818-W.

ELECTRICAL ENGINEER, (Man. '46) S.E.I.C., age 24, desires sales engineering position. Limited sales experience but possesses great potential. For full details of qualifications apply to File No. 2846-W.

YOUNG STATISTICAL METHODS ENGINEER, Jr. E.I.C., B.A.Sc., would accept some consulting work at night or Saturdays. Thoroughly familiar with statistical analysis of data, sampling inspection plans and charting methods for process, quality or material control. Actually employed as a technical advisor in statistical methods by a large industrial plant in Montreal. Apply to File No. 2862-W.

RECENT GRADUATE IN ENGINEERING Physics, S.E.I.C., B.A.Sc. Toronto, age 23, single. Specialized in Electricity and Communications. 1 year experience in Electrical Field, available for Permanent position. Apply to File No. 2869-W.

CIVIL ENGINEER B.A.Sc. Toronto 1940. Jr. E.I.C., P.Eng. Ontario. 7 years experience plant maintenance, cost analysis and project development in small part machining and sheet metal industry including all phases of forming and welding. Desire this type of work in Toronto area. Apply to File No 2870-W.

MECHANICAL ENGINEER, Jr. E.I.C., P.Eng., (Ont.), graduate of the U. of Sask., '42 with distinction ,Member of American Society for Metals. age 28, single. Five years experience in machine shop production and methods: changes in tool and product design, heat treating, inspection and testing of metals and materials; arc and oxy-acetylene welding; foundry problems in cast iron, brass, bronze, malleable iron and die castings. Completed a two year engineering apprenticeship course in a large manufacturing plant. First prize for technical paper. Health excellent. Willing to work on probation for one month. Desires position to utilize the above experience. Apply to File No. 2871-W.

WORKS MANAGER, GRADUATE ENGINEER, M.E.I.C., P.E. Ont., 15 years, experience in executive and production management in Electrical or Mechanical field. Available immediately. Toronto area preferred. Apply to File No. 2873-W.

MECHANICAL ENGINEER (Sask. 46), S.E.I.C., at present employed but available on short notice, desires position in maintenance, plant, production, or industrial engineering. One year's experience in draughting and detail work. Prefer to work in Ontario. Apply to File No. 2874-W.

CIVIL ENGINEER, Jr. E.I.C., veteran, age 31 with experience in road construction including layout, design, selection of materials as well as supervision and direction of equipment; also experience in building design. wishes to contact firm dealing primarily in earth and concrete construction or building construction, design or supervision. Location in Western Canada preferred. At present employed in general engineering. Apply to File No. 2875-W.

ELECTRICAL ENGINEER, M.E.I.C. Thorough grounding in cable manufacture development and estimating. Also extensive instrument making experience in Government laboratories. Interested in applying above capabilities in Toronto area. Present work power development. Age 26, single. Apply to File No. 2876-W.

ELECTRICAL ENGINEER, S.E.I.C., P.E.Q., graduated '46 with two years experience in electrical installations in public buildings desires any kind of work, preferably in the vicinity of Montreal, Ottawa or Toronto. Available July 1st. Age 26, married, bilingual. Apply to File No. 2881-W.

MECHANICAL ENGINEER, Jr.E.I.C., McGill '44, age 26, bilingual, single, good health. Due to an unusual situation, has not been employed in work of an engineering nature since graduation. Would prefer to locate with organization building custom-built automatic industrial machinery. Available on short notice for assignment in Canada or U.S.A. Apply to File No. 2882-W.

GRADUATE MECHANICAL and ELECTRICAL ENGINEER (M.I. Mech. Eng. & A.I. Electrical Eng. of England—M.E.I.C., P.Eng. Ontario.) with sound experience in mechanical and electrical plant and foundry production and factory management including industrial engineering methods of plant layout, job evaluation, work measurement, labour control and machine utilization; at present engaged as plant manager in complete charge of engineering works, desires to better his position. Apply to File No. 2883-W.

ELECTRICAL ENGINEER, M.E.I.C., P.Eng., age 30, married. Ex-Naval Lieut., 12 years experience including maintenance mines, process industries; elect. mfre., C.G.E. test; at present employed but seeks connection with aggressive organization. Available November. Prefer Ontario Location. Apply to File No. 2884-W.

RECENT GRADUATE, S.E.I.C., Toronto, 1947, Metallurgical Engineering. Desires position in Central or Western Ontario to gain experience in production. Interested also in Industrial Relations and Engineering. Previous experience in aircraft and farm implement manufacture. Apply to File No. 2888-W.

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CONTENTS

COVER PICTURE

Aside from its being a rather appealing photograph, the *Journal* feels that the cover photo should be of particular interest to Institute members. It is our President's sloop *Tramp Royal*, defending champion in the long-distance cruising race for the Freeman Cup which climaxed the week's events in the regatta held on Lake Ontario by the Lake Yacht Racing Association in August.

We are hoping to persuade Colonel Grant to give us a short article on his yachting activities and the distinguishing features of his entirely Canadian-designed sloop—if only to prove that Institute presidents are also human and have hobbies like anyone else.

CANADA'S NORTH MAGNETIC POLE

J. M. WARDLE, M.E.I.C.
Director, Surveys and Engineering Branch, Department of Mines and Resources, Ottawa, Ont.

In view of the fact that the Department of Mines and Resources is, at this time, making extensive studies of the location and movement of the North Magnetic Pole, the Journal *believes Mr. Wardle's paper to be useful and informative to all engineers. The paper gives a general outline of previous work by Canadian and Foreign explorers and magneticians and relates, in the text and the chart, some details of former positions and movements of the North Magnetic Pole.*

The discovery of a strongly magnetized area in northern Canada which we now know as the North Magnetic Pole, was one of the results of studies in terrestrial magnetism that began in the year 1600. The polar properties of magnetized needles were known as early as the twelfth century, but Gilbert was the first scientist to suspect, in the year 1600, that the earth had magnetic properties and that all magnets on its surface direct their poles to the magnetic poles of the earth. Canada has been fortunate in having near the centre of her Arctic Islands, as a major navigation and travel aid, an area where the magnetic axis of the earth reaches its surface. The strong attraction of all magnetized articles toward this area resulted in its being designated the North Magnetic Pole. However, from the scientific standpoint this Pole is not a point but an area some 500 miles north and south by 150 miles east and west, over which a strong magnetic declination or dip, as great as 88 degrees, can be observed. Somewhere within this large expanse is a comparatively small centre area, or perhaps two such areas, where magnetic instruments would show a 90 degree dip and there would lie the North Magnetic Pole at the time of the observations.

An interesting and complicating feature of the existence of this magnetic phenomenon is that the maximum magnetic force varies in intensity and also in location. This indicates continual magnetic disturbances in the earth's crust and the shifting of the maximum concentration point of the magnetic lines of force. The position of the Magnetic Pole is so important to navigators, explorers, and travellers generally in the unsettled areas of our northern hemisphere, that its true location from time to time is a matter of great importance. The accurate construction of all magnetic charts, particularly those for use in northern Canada, depends on the precise knowledge of the position of the Pole. Scientists have been computing this from magnetic observations available ever since the time when expansion of colonization and trade was dependent on the mariner's compass. Computing scientists have been many but scientists who actually have visited the neighbourhood of the Magnetic Pole have been few.

As previously indicated the Magnetic Pole is that point at which the earth's magnetic field is exactly vertical. There the dipping needle, which points to the horizon at the magnetic equator, points toward the centre of the earth and the compass needle, dependent as it is on some horizontal force to hold it in its direction, is useless. The pole does not remain rigidly fixed in one position. It describes a methodical daily orbit but, during magnetic disturbances which are usually attended by sun spots, auroras and radio communication troubles, it moves rapidly about in an area whose radius is of the order of fifty miles. Then, too, during the past century the pole has been travelling northward. It will be understood, therefore, that when a position for the north magnetic pole is indicated it represents the centre of an area at a particular period.

The north magnetic pole is the centre of a radial system of magnetic meridians just as the north pole of the earth is the centre of a system of geographical meridians. The angle between a magnetic and a true or geographical meridian is the magnetic declination. The declination, often called the variation, of the compass represents the principal magnetic element used in navigation. If a rigid system of magnetic meridians can be established, then the declination may be known for any place where observations are lacking. Since a compass needle lies along or tangent to a magnetic meridian, it necessarily follows that a compass may be used to indicate the direction of the magnetic meridian at any place and if sufficient observations are made in Canada from south to north the intersection of the meridians and consequently the position of the magnetic pole can be fixed. The compass will give reliable information on the ground to within probably fifty miles of the magnetic pole. The suspected area must be circumscribed by magnetic stations and then the mean position of the pole can be determined by computation. Greater precision may be attained by an intensive survey of the circumscribed area since certain geological formations cause deformation in the earth's magnetic field.

Ross was the first to actually determine the position of the north magnetic pole by observations made on the spot, or very close to it. On June 2, 1831, at Cape Adelaide on the west coast of Boothia Peninsula, he measured a dip of 89 degrees 59 minutes which was just one minute short of the dip of 90 degrees to be found at the pole. The spot was in north latitude 70 degrees 5 minutes and in west longitude 96 degrees 46 minutes. Ross did not find the pole by chance. Observations made by Arctic explorers prior to Ross's voyage of 1829-33 indicated the vicinity of Cape Adelaide as the most probable location. Ross, with this advance knowledge and the results of analyses of magnetic data gathered at an observatory at his winter quarters, actually followed the indications of his magnetic instruments on foot until the pole was reached.

Amundsen was the next scientist to make observations in the vicinity of the magnetic pole. He used more precise instruments but his methods were akin to those of Ross. Amundsen established a magnetic observatory near Peterson Bay, King William Island, which operated from November 1903 to May 1905 and furnished rigid control for field observations made during an intensive magnetic survey of a portion of Boothia Peninsula. The position of the magnetic pole for 1904 thus evaluated was latitude 70 degrees 30 minutes and longitude 95 degrees 30 minutes. This suggested that since 1831 the pole had moved about forty miles in a northeasterly direction.

Sketch map of portion of Canadian Arctic showing positions assigned to north magnetic pole. The older positions of Ross and Amundsen were determined by direct observation near the pole; positions estimated by the Carnegie Institution and by Spencer Jones were from stations remote from the pole. The most recent and probably the most accurate determination, by Madill, was made from stations in North West Territories and islands close to the pole. The magnetic pole has moved approximately two hundred miles northward in the last century.

All positions assigned to the north magnetic pole since 1904 and up to 1946 have been computed principally from magnetic data applying to the region between latitudes 60 degrees north and 50 degrees south. Eminent scientists in Great Britain, the United States and Russia have made careful analyses of such data and determined positions of primary and secondary poles ranging from three to eight hundred miles north of the 1904 position. These locations, however, do not appear to be entirely valid when Canadian observations made north of latitude 60 degrees are examined.

The Dominion Observatory, Surveys and Engineering Branch, Department of Mines and Resources, is the official custodian of the north magnetic pole. The Magnetic Division of the Dominion Observatory since its establishment in 1905 has been responsible for conducting a systematic scientific magnetic survey of Canada. Over one thousand magnetic stations have been established in Canada and Newfoundland and the Division operates two magnetic observatories, one at Agincourt, Ontario, and the other at Meanook, Alberta. At these observatories continuous photographic registration of the changes in direction and intensity of the earth's magnetic field is maintained. Magnetic data gathered by Dominion Observatory magneticians are used in the construction of magnetic charts of Canada for use of navigators, surveyors and geophysical prospectors.

The Observatory's network of magnetic stations was extended north of latitude 60 to Great Slave Lake in 1922 and the mouth of the Mackenzie in 1923; to Nueltin Lake in 1922, Seal River in 1923, Hudson Strait in 1928, Ellesmere Island in 1934 and Baker Lake and Repulse Bay in 1937; to Coppermine and Cambridge Bay in 1945 and Fort Ross in 1946; and to Denmark Bay in 1946. Since 1943, Dominion Observatory magneticians have had the close cooperation of the Geodetic Service and Topographical Survey in gathering magnetic data in Northern Canada and during this period alone over two hundred additional stations have been occupied north of latitude 60 degrees.

The Magnetic Division has been fully aware for many years that the north magnetic pole was travelling in a northerly direction. This was apparent from the results of observations made periodically at Dominion Observatory repeat stations extending from Newfoundland to Alaska and from many invaluable magnetic observations made in the Canadian Arctic by such scientists and explorers as Jackson, Stefansson and Burwash. However, it was only after the completion of Exercise Musk-Ox and the Eastern Arctic Patrol of 1946 when J. S. Innes reached Denmark Bay, Victoria Island, and P. H. Serson reached Fort Ross, Somerset Island, that a position of the north magnetic pole could be indicated with assurance.

It appears, after careful analyses of recent observations, that the north magnetic pole is presently situated in Somerset Island in latitude 73 degrees 15 minutes and longitude 94 degrees 30 minutes. This indicates a northerly shift in position of about two hundred miles since 1904.

Despite popular belief, magnetic observations made in aircraft during circumpolar flights are not conclusive in determining the ground position of the magnetic pole. Such observations, however, afford evidence of a northerly displacement of the 1904 pole.

Although a magnetic station has been established at Fort Ross within one hundred miles of the apparent position of the magnetic pole, additional stations must be established in this area to satisfy exacting researches of Department officials. During 1947 the Department of Mines and Resources is

(Continued on page 498)

Editor's Note—As this article went to press survey parties returned to Ottawa and have reported additional findings. These will be published as an addendum in the next issue of the *Journal*.

THE CANADIAN WELDING BUREAU

The Newly Formed Approvals Division of the Canadian Standards Association

RONALD M. GOODERHAM, M.E.
Welding Consulting Engineer and General Manager, Canadian Welding Bureau, Toronto, Ont.

A paper delivered at the Sixty-first Annual General and Professional Meeting of The Engineering Institute of Canada, at Toronto, Ont., on May 9th, 1947

This important paper will interest all engineers who deal with metals. Tracing the early growth of welding on through the war years, the author points out the problems arising from rapid wartime growth and cautions we have yet much to learn. The needs for codes and uniform standards are emphasized. The prime function of the Bureau is shown to be that of testing and approving fabricators. Their essential qualifications, and the benefits from certified codes and fabricators are listed. A summary of the Bureau's activities is given and the lack of welding knowledge is pointed out. Suggestions are added for extending the Bureau's functions to embrace research, welding schools, libraries and other matters.

This opportunity of presenting the Canadian Welding Bureau to members of The Engineering Institute of Canada is not only appreciated in itself, but is furthermore welcomed as recognition of the growing importance and maturity of welding, of its accomplishments in the war, and of its probable importance to Canada in maintaining her position as one of the leading trading and industrial nations of the world.

Origin and Early Growth of Welding

It is perhaps fitting to recall that the first welding patents in this new world were taken out in 1887, the inaugural year of The Engineering Institute of Canada. Welding of course dates back to the bronze age but, in its modern form using the heat of gas and electricity, its major growth is well within the knowledge of all of us here.

Oxy-acetylene welding as we know it today was a French development which attained commercial use around 1906. Oxy-hydrogen welding was even earlier and resistance welding was conceived, but used mostly experimentally, long before that date. Many countries have contributed to welding, to its origin and development—Russia, Sweden, Germany, France, Britain and the U.S.A. Fundamental developments have been chiefly British and European, while America has, from an early date, lead in its application and the promotion of production methods. Canada, as is her custom and opportunity, has been the beneficiary of both.

It has become trite to speak of welding as being only in its infancy and sometimes one discerns a note of almost apology, that with all its inherent advantages, it has not attained to greater and more responsible applications. Today welding is no longer an infant. It is instead a lusty young man, assuming responsibilities. Some will say this youth is more full of enthusiasm than experience, but to those I would suggest that there is available a wealth of both experience and research accomplishments of which little is known and less advantage is taken.

Wartime Developments and Accomplishments

During the last two decades welding has gone through a period of depression and a period of war. The pent up developments of the first period resulted in a flood of accomplishments in the second. In the United States the great tank and ship-building programmes were largely carried out by welding. In Great Britain welding was called upon to fabricate in large measure those two outstanding and original achievements—Pluto, pipe lines under the ocean; and Mulberry, the invasion harbours. Likewise the British Bailey bridges were a welded product. Millions of bombs and mines of all sizes were welded and the process, in all its phases, used extensively in aircraft production. By 1943 welding was big business in the United States. Over $360 millions were spent on welding material and equipment, and products produced by welding were valued at over $100 billions in that year.

All these accomplishments might be called 100 per cent successful with the possible exception of the Liberty Ship programme, where important failures on 3 per cent of the vessels were recorded. Such failures do not condemn a process — they merely serve, in my opinion, to confirm its inherent qualities when considered in the light of its mushroom growth and employment of untrained designers, engineers and operators. However inexperienced, they, and the process, served to produce a ship in 28 days in World War II as compared to 243 days in World War I.

Today we have the Director of Naval Construction of the British Admiralty urging shipbuilders to produce 100 per cent welded hulls as soon as possible. The head of one of the principal British Classification Societies is saying that he " would have no hesitation in accepting a 100 per cent welded ship today, if due regard were given in the design to the fact that she was welded ". The British Admiralty Committee, investigating weld failures in the United States vessels, concludes—" That given sound design, good workmanship, and tough steel the reliability of welded ships is beyond question. These are all conditions essential to any type of fabrication and any failure of welded ships was due to departure from these principles ". The same committee go on further to advise that experience during the war showed that the welded ship withstood damage by bombing, underwater explosions and stranding remarkably well.

We have today, and have had for years, welding being used for the construction of pressure vessels at pressures and temperatures impossible by any other method. The Canadian Pacific Railway have recently put into service the first welded locomotive in this country.

A Corrective for Over-Enthusiasm

These are some of the accomplishments of welding. They lead not to elation but to the sobering question as to why welding with all its merits and medals is not more generally employed. The great majority of welding protagonists are enthusiasts, if not even fanatics. They have gone ahead with a spirit of adventure and pioneering self-reliance. To them welding is progress. To them it makes for better and more abundant living, and they would be failing in their duty if they did not promote it with all their energies and convictions.

But perhaps this enthusiasm of the welding fraternity has speeded its progress in some unimportant places, but retarded it more in others of greater consequence. Perhaps in their haste and personal conviction they have not marshalled their facts sufficiently to assure others. Perhaps they have not presented engineers with the basic data which they require. Without these facts an engineer is rightly conservative. To unsupported over-enthusiasm he has applied a corrective of ultra-conservatism.

It has been said that an engineer's duty is to discover the fundamental facts and then to venture. This is a creed to which I heartily subscribe, but it takes time and money. To have every engineer who should, or wishes to, use welding marshall his own facts is too costly. Especially is it too costly for small Canadian firms. And yet, had it been invariably done, welding would be far more extensively used than it is today.

So far I have said nothing to you concerning the title of my address, the Canadian Welding Bureau. I have been trying to show that welding, because of its present stage of both maturity and immaturity, needs such an organization. It needs one that can present the assimilated unbiased facts of welding to industry in the form of usable codes and standards for both design and fabrication.

This then, I present to you as one of the prime purposes of the Canadian Welding Bureau. The Bureau itself does not actually draw up such codes. It may promote, recommend, and assist, but the codes themselves are a product of committees appointed by the Canadian Standards Association, whose members are drawn from industry.

The Canadian Standards Association and the Value of Codes

Having presented my first function of the Canadian Welding Bureau, may I momentarily digress and remind you that the Canadian Standards Association, and therefore the Canadian Welding Bureau, is a creation of industry, operated and supported by industry for what is conceived as its own benefit. It is not a mandatory Government authority, but a voluntary organization of industry, conceived for its own good.

Fulfilment of the codes and standards is not compulsory. They are issued as a guide and service to industry. They become law only when adopted in whole or in part by some governing body. Their purpose is to promote sound and orderly progress. Standards may be taken as a measure of an industrial nation and of a process. They are a certificate for domestic consumers and a hallmark for export buyers. Their coordination internationally serves the nation in both peace and war. They are a tool for industry, a handbook for the engineer, a current textbook for the student, and a specification for the buyer.

Canada has not been without welding standards in the past, but they are not now adequate considering her increased stature as an industrial nation and the parallel advancement of welding, particularly during the war.

The Problems Arising from Wartime Growth

The mushroom growth of these war years created problems which both users and makers of welding equipment were quick to recognize, and desirous of correcting. Wartime design largely originated from within a relatively small group and not generally from industry, and often not in this country. A few were highly trained, but most designers, who would in peacetime be creating welding designs to employ the vastly expanded equipment in the hands of industry, had had little actual experience.

To use this available equipment there existed a large body of operators. Some few hundred of these were highly skilled and had been largely responsible for the Polymer rubber plant, the atomic energy plant and similar important projects. On the other hand, the majority would be generously termed as semi-skilled. Under wartime controls and inspection such semi-skilled operators could be used to advantage, and with safety. With the elimination of such controls conditions would change, and there existed the danger of these unskilled men promoting themselves or being promoted to work of importance. It may be said that there were many trained in welding, but few in the limitations of welding.

The solution was not to upgrade these men—this would be a job of too great a magnitude. More important, it would unnecessarily increase industry's labour rates. It should be understood that the great majority of welding, and even the most important, for example pressure vessels, requires not an all-position all-metal operator, but a one-position one-technique individual. These so-called semi-skilled welders served with marked success during the war under wartime controls. Their use in peacetime simply demanded similar control, and if possible a voluntary control imposed on industry by itself, for itself. That control is the Canadian Welding Bureau.

Confusion and Cost Arising from Too Many Standards

Codes and the means of exerting control by such codes already existed, as fabricators were actually aware. But these were foreign codes; some from Great Britain, some from the United States, and they existed in a multiplicity of form and merit. Authoritative bodies in Canada were using them; sometimes one, and sometimes another. There existed the strong and disturbing possibility that they might be variously adopted by control organizations in Canada, creating a confusion of standards with a resulting unnecessary expense to Canadian industry.

As a consequence, those mostly concerned—the fabricators and the welding industry itself—sought a Canadian means, both of control and guidance, which should be the minimum necessary to ensure the maximum benefits inherent in the process and a further healthy unrestricted growth unmarred by failure or disaster.

It should not be thought that they were unduly critical of the imported codes. Many of their principles have been or will be adopted into Canadian Standards because they are sound and proven, and further to ensure the maximum possible degree of international uniformity. Indeed the founders of the Canadian Welding Bureau were greatly impressed by the benefits which had accrued directly or indirectly to all Canadian citizens by the control that had been exercised by certain of the Provinces on pressure vessel welding through the adoption of the American Society of Mechanical Engineers Boiler Construction Code and its successful regulation under their jurisdiction. This has resulted in welding being employed, without failure or danger, in the most important application conceivable, and with very large economical advantages to the purchasers and users. It was judged that similar assistance would be equally helpful in the other prominently developing fields of welding application.

Desirability of Uniform Dominion-wide Standards

Canadian, and most important Dominion-wide standards were obviously desirable. The assistance and authority of the Canadian Standards Association was sought and finally obtained to formulate, as required, the necessary codes covering all phases and applications of welding, and to establish the Canadian Welding Bureau to provide the necessary guidance and regulation.

By formulating our principal welding codes at this period of our own industrial development, and that of welding, we are in a sense fortunate, and are considered so by our neighbours. It might be said of the past that we had neither a code to guide nor codes to confuse. We start with almost a clean slate. We have an opportunity to benefit by the experience and mistakes of others. We are free to establish a nation-wide uniformity and simplicity of standards which can well be the envy of older industrial nations.

Prime Function of the Bureau—Testing and Approving Fabricators

Although the Canadian Welding Bureau will recommend standards and be available to assist in their formulation, their chief duty will be to ensure that Canadian fabricators are able to meet such standards. For the immediate future at least this will be their principal job. Even the most partisan advocates of welding recognize that the existence of standards is not alone sufficient to ensure their use or that any fabricator, although credited with the best of intentions, is necessarily able to meet the specified requirements.

The Canadian Welding Bureau has therefore been assigned the responsibility of testing and approving fabricators whose organization as a whole is able to meet the required specifications. This, then is the second function of the Bureau and its most important one.

Such approval or certification of fabricators is chiefly contingent on their having available or access to the following: 1) Engineering personnel competent to design welded products and to specify and control the welding procedure used; (2) Supervision capable of directing and maintaining proper procedure and quality; (3) A qualified staff of operators; (4) Welding equipment conforming to Canadian Standards Association requirements and suitable for the work being undertaken by the fabricator.

You will, I know, immediately recognize in this an important development, and one which we are fortunate to be able to take.

Benefits from Certified Codes and Fabricators

Your minds will likewise at once conceive the principal benefits and opportunities which now arise. Engineers, consultants, architects, buyers, users, government officials and others are presented with authoritative codes of good welding practice and a list of firms, each of whom can and does with a high degree of assurance turn out sound safe work.

It is now possible, without burning the midnight oil and becoming yourself a welding authority and code maker, to derive the benefits of welding in full by specifying that the work be done by a qualified and approved firm and in accordance with the applicable code. If you are thinking not of buying but of selling, then first design to a code standard and have your organization qualified by the Canadian Welding Bureau as able to meet the required level of proficiency.

I know, however, that questions will have arisen already in the minds of some of you because I have previously experienced the reactions of many when the formation of the Bureau was first canvassed. Let me therefore hasten to assure you again that the Bureau is a creation of industry for industry. It is not autocratic or restrictive. It is not for the benefit of the big to the exclusion of the small. It will serve to confirm the qualifications of some older, larger and established firms, but more important, it will provide an undeniable stamp of approval to those qualified though small and relatively unknown firms, who deserve recognition and the opportunity of expansion.

Although it is the obvious duty of the Bureau to restrict approval to those firms who are adequately equipped and staffed and able to meet the various code requirements, it is likewise their duty to assist those firms who desire certification, to meet the specified qualifications.

Essential Qualifications of Certified Fabricators

You will, I trust have noted with approval that a firm to be attested by the Bureau requires that their operators, supervisors and engineers all be fully competent. It is recognized that although an operator may have passed a test, consistently good work is not necessarily assured as a consequence, and that such assurance is not the responsibility of the supervisor. He must be properly trained, sufficiently experienced and capable of demanding and getting uniformly sound results.

Further, it is recognized that capable operators and supervisors do not necessarily ensure a quality product, if the design is defective and the welding standards and procedure missing or inadequate. In addition, welding equipment and equally auxiliary equipment for material and joint preparation must likewise be satisfactory. It is on these factors that assessment is made as detailed in Canadian Standards Association qualification code W-47 under which the Bureau operates.

I would ask you to note that only the firm as a whole is certified. Neither the operators, supervisors nor engineers are individually given a certificate. It is the combined result of their endeavour and co-operation which is approved. It should also be appreciated that the individual products of a firm are not tested or approved and that no such stamp is issued for use on products. It is the firm's ability to meet a standard of quality and their apparent consistency in doing so that is attested.

Firms may, and they will be encouraged to, indicate their certification by the Bureau on their letterheads or other advertising media. The Bureau itself will from time to time issue lists of approved fabricators for the guidance of engineers, buyers, municipal and government departments and other interested bodies.

Summary of Bureau's Activities

In summary, the present activities of the Canadian Standards Association and the Bureau, respectively, are to issue codes and to approve fabricators. To date, efforts have been concentrated on arc welding standards. Code W-59 entitled " The Welding of Bridges, Buildings and Machinery " has been published. The electrode approval code W-48 is to be available July 15, 1947, and the Qualification Code W-47 is in its final draft.

Other standards are projected, and in particular a committee is currently being formed to establish codes pertaining to resistance welding. Such codes are at present non-existent in Canada and in view of the rapid increase in the use of this process their compilation at an early date is considered advisable and a valuable service to industry.

The Bureau's scope is not confined to any type of welding or any field of application. Its purpose is all embracing and its terms of reference at present unlimited. It is not its purpose to interfere with established standards nor to saddle industry with overlapping controls involving any unnecessary time and expense. It recognizes the success of existing controls such as those for pressure vessels and wishes only to accommodate other applications of welding in an equally successful way.

The Bureau's purpose is to serve industry and welding. What in addition to its present activities this may involve, it is perhaps rather early to conjecture. Additional needs are fairly obvious and also, how similar needs have been met in other countries is a matter of record.

Unfortunate Lack of Welding Knowledge

The Bureau's experience to date has confirmed an unfortunate lack in Canada of welding technicians and welding design engineers or draughtsmen. Further, there has never been in the past, and no opportunity yet exists, for acquiring the needed training for such engineers in this country. Yet it has been said with good and unbiased authority — "The greatest unexplored field today is the design possibilities that are inherent in the fabrication of welded steel. The potentialities are almost unlimited ".

We have as yet explored only the obvious applications of welding, that is, those fields wherein advantages lie and are obtainable almost without thought or effort. We have neither developed the refinements of design, nor of production methods that will realize the ultimate advantages and economies of the process. I suggest to you that there will be a vast difference between the welded construction of today and the designed-for-welding fabrications of tomorrow. As yet our university courses make but little more than passing reference to the subject. The present four year engineering curricula are already overcrowded, and it would be a disservice to further load or dilute them. Specialized post graduate courses, or five year degree courses would appear desirable and ultimately essential. These of necessity are some years off, even with the most enthusiastic and inspired University leadership.

Possible School of Welding and Cutting

It has been considered possible that the Canadian Welding Bureau might establish courses for graduate engineers, draughtsmen, supervisors, teachers of welding and others to meet the immediate needs of industry and rectify as quickly as possible the conditions into which the accelerated advance of welding has brought us. This would parallel a similar service rendered by the French counterpart of the Bureau in Paris, which is entrusted with this duty by the French Government and empowered to award degrees. Incidentally, it may be noted, the French Bureau for this and other activities related to welding, occupies premises equivalent to the average city high school. Equal or greater attention is devoted to welding in other industrial countries, although in most the activities are more dispersed.

Although the possibility of instituting such training has been considered even in these early formative days of the Bureau, their duty in this matter may disappear due to a recent proposal to carry on such a programme with the coming expansion of an existing educational institution.

To this the Bureau will tender its active and enthusiastic support as it will indeed to all societies, institutions, departments and organizations attempting to serve the advancement of welding to the general good. It does not propose to attempt what others can do equally well or better nor what can be done through established channels and institutions. Its function will be limited where possible to initiating, encouraging and co-ordinating the various welding activities of the nation.

Participation in Research—The Advantage

To welding research it could render a service which might be considered typical. In Canada at present there is little if any welding research being carried forward with the possible exception of some short term projects of the Bureau of Mines. We may complacently conclude that Britain, the United States, Belgium, Sweden, France, Switzerland and others will carry on all that is necessary. They are in fact doing so, and those of us who are interested have general access to the results. The disadvantages are that too few of us are directly interested or actively concerned. Results, although important, have not the intrinsic educational value of actual participation with its trial and error. Obviously we cannot carry on a vast welding research programme, but we could assume responsibility for sections of research in co-operation with other nations and I am sure our participation would be more than welcomed.

We have admirable institutions for such work—our National Research Council, The Bureau of Mines, the Ontario Research Foundation and all our Universities. Research undertaken in these institutions will serve to inform us in the earliest stages with welding thought and development. It will bring us into intimate contact with other research work and workers of other countries. It will further serve to acquaint at least one professor and one post graduate student in each participating university with some phase of welding and may eventually lead to a measure of welding education, and the welding engineers which industry will need in the normal course of progress.

There is one welding problem in which Canada should be keenly interested, and in the solution of which she might conceivably take the lead. That is the formation and behaviour of welds at low temperatures. There are opinions on this subject but few facts. Such knowledge is important in peace and could be vital in war.

Welding Libraries

Further, we are inadequately equipped with welding libraries and particularly one complete and comprehensive compilation or index of the world's welding literature both past and current. Surely we should not be without these relatively inexpensive sources of information. Through such an index, and taking advantage of the loan privileges of the American libraries, it should be possible to assemble for a Canadian

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ECONOMICS OF WATER DIVERSION

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A paper delivered before a joint meeting of the Winnipeg Branch of the Institute and the Manitoba Association of Professional Engineers on March 14, 1947, and before the Montreal Branch of the Institute on April 10, 1947

This paper draws attention to the advantages that may frequently be gained by diversion of flow into a river on which hydro electric power is already developed, from an adjacent watershed, rather than by further development of the river itself. Many instances of such diversions of flow are given, from Canada, Newfoundland, the U.S.A., Brazil, Britain, Norway, Russia, Switzerland, Korea, India and Egypt.

This paper is an attempt to portray the broad economic value of water diversion for power purposes. Considerable attention is given to existing diversion developments throughout the world, with emphasis placed on those economic aspects of particular significance in each case. Water diversion for power generation is of great interest to Canadian hydraulic engineers, and citizens in general, because our industrial growth is nourished by the life blood of hydro-electric power. This is especially true in the great manufacturing provinces of Ontario and Quebec, which have no known exploitable deposits of coal or oil.

Diversion is here used in the sense of diverting water from one watershed to an entirely separate but adjacent watershed, rather than the by-passing of a bend or reach in the river, or a partial diversion designed to effect a concentration of head, where the flow is returned to the river of origin at a point downstream.

Water power is ordinarily associated in the public mind, and admittedly the minds of many engineers as well, with waterfalls and rapids on rivers where necessary head is visible or can be concentrated by dams and diversion canals, flumes or tunnels. The usual governmental statistics on potential waterpowers tend to emphasize this trend of thought because they deal with visible waterpowers. Little if any attention is ordinarily paid to the "invisible" waterpowers which can be created under favourable topographical conditions by diversion of waters from one watershed to another.

Many people, and governments also, are under the impression it is only necessary to build a power plant to bring an economically sound enterprise into being. This is not so. In addition to economically reasonable development costs for the project itself there must be a market available, or capable of being developed, within a reasonable transmission distance from the power site.

Diversion of water from one watershed to another sometimes permits literally transporting the power resources to an existing market.

Development of a market for the power resources of a valley is usually a long process. Notable instances of this are the St. Maurice and Saguenay Rivers. The broad conception of power development on the Saguenay took place in the latter part of the 19th century; effective field engineering studies were undertaken in 1913; but not until 1923 was the construction of the Isle Maligne power development put in hand. The first stage of the great Shipshaw hydro-electric project was started in 1928 and the final stage, commenced in 1941, was completed in 1943. It took two world wars, great engineering skill and financial courage to bring industrial development in the Saguenay Valley to its present stage, where the market absorbs the major part of developed power resources, a substantial part being, however, utilized as secondary power in electric steam generators.

Water Diversion in Historic Times

Water diversion for irrigation, water supply and military purposes has been practised since the dawn of recorded history. Ancient Babylonia owed its prosperous agriculture to an elaborate system of canals and irrigation ditches. These canals, criss-crossing the plain between the Euphrates and the Tigris Rivers, were in many instances fed from the Euphrates and discharged into the Tigris. The Nile, in the days of the Pharaohs, as now, was the life stream of Egypt through use of its waters for irrigation and replenishment of the fertility of the land, by deposition of silt from its flood waters. About 2000 B.C. the Pharaohs of the Twelfth Dynasty converted a large depression in the Libyan hills into a huge reservoir for storage of flood flows from the Nile and release during periods of low water.

Water diversion for sanitary supplies was practised by the Romans and Greeks. The Bible (II Kings 20:20) notes how Hezekiah supplied Jerusalem. The Romans built some 380 miles of aqueducts to collect potable waters from the hills surrounding Rome. Many interesting details of these diversions have come down to us from the writings of Frontinus, water commissioner for Rome about 100 A.D. These show the quality of workmanship and capability of those early hydraulic and civil engineers, demonstrated even today by their durable works.

Water Diversion in Modern Times

In modern times, water is diverted from one watershed to another for water supply, sewage disposal, irrigation, navigation, and for power. In addition to diversion primarily for the first four purposes mentioned, power generation may be a substantial secondary objective. In the following discussion of diversion projects only those projects in which power generation is effected will be treated.

WATER SUPPLY

Among many notable water diversions for the supply of metropolitan areas are those of the Pacific Coast States of the U.S.A. One of these is the Hetch Hetchy Aqueduct, on which the great city of San Francisco depends for its industry and well-being. This aqueduct can carry 400 million gallons per day (mgd.) of potable water from the high mountain watershed of the Tuolumne River, 167 miles away. As illustrated by Fig. 1, the 650 sq. mi. watershed ranges from an elevation of 13,090 at the crest of Mt. Lyell to 3,720 at the Hetch Hetchy reservoir created by O'Shaughnessy Dam. Storage in the reservoir amounts to 117 billion gallons.

The aqueduct carries the water from the Tuolumne watershed under the San Joaquin River, through two tunnels piercing the Coast Range, and under San Francisco Bay by gravity alone. The longer tunnel, 25 miles in length, is probably the longest and most difficult ever undertaken. Inherent 24-hour average power possibilities amount to some 187,000 hp. of which 75,000 hp. is developed in the 1250 ft. head Moccasin power plant.(1)

The Mountain and Foothill tunnels have a capacity of 400 mgd. or more. The present San Joaquin pipe line capacity is approximately 70 mgd. The Coast Range tunnel capacity is about 250 mgd. Two existing Bay pipe lines have a combined capacity of about 114 mgd. Additions will be required for the ultimate capacity of 400 mgd. delivery to San Francisco when needed.(2)

Actually, if no water is diverted to San Francisco, all the water passing through the waterwheels of the Cherry River and Moccasin power plants is returned to the watershed of origin. In the case of the Cherry River plant, water taken from the Cherry River is returned to the Tuolumne River a short distance above the junction of the Tuolumne and the Cherry. At the Moccasin power development water diverted from the Tuolumne passes through the turbines and, at a point downstream from the plant, water not diverted through the aqueduct to San Francisco is returned to the Tuolumne. Gross energy production from the two existing power plants is about 531 million kwhr. per year.

SEWAGE DISPOSAL

An interesting instance of diversion from one watershed to another is the Chicago Sanitary Canal, whereby water is taken from Lake Michigan in the Great Lakes-St. Lawrence watershed to the Mississippi watershed by way of the Des Plaines and Illinois Rivers. The diversion was constructed primarily for sanitation and protection of the water supply of the city of Chicago and adjacent area, under a scheme whereby the huge volume of raw industrial and domestic sewage is intercepted, diluted and transported through the Sanitary Canal, Des Plaines and Illinois Rivers to the Mississipi (3). This diversion creates facilities for navigation and hydro-electric power.

The idea of using Great Lakes water for sewage disposal was first conceived in 1889, when Chicago decided to construct a drainage canal 162 to 300 ft. wide, 33 miles long and with a uniform depth of 24 ft. Constructed under Illinois legislation of May 29, 1899, the canal was designed to divert 14,000 cfs. of water to take care of sewage from the 437 sq. mile Chicago Sanitary District, as well as to improve navigation on the forerunner of the so-called Lakes-to-Gulf waterway and provide Chicago with hydro-electric power.

The Sanitary Canal was built without the sanction of the U.S. Congress, the only existing authority being a permit of the U.S. Secretary of War dated January 17, 1903, whereby permission was granted to divert 4167 cfs. after March 31, 1903. The Sanitary District disregarded the stipulations of the permit and expanded its diversion facilities by building the Calumet-Sag Canal (Fig. 2), thus increasing the diverted flow. Not only were the levels of the Great Lakes and St. Lawrence River lowered by tangible amounts, thus affecting navigation, but the dilution of sewage proved insufficient to avoid creation of a nuisance to communities on the Des Plaines and Illinois Rivers.

Extensive litigation followed, notably the suit of the Attorney-General of the United States in the United States Circuit Court, Northern District of Illinois, designed to assert the paramount authority of the United States over the Sanitary Canal diversion and all acts tending to injure the capacity of navigable waters of the United States. This was followed by another suit to stop the Sanitary District from diverting more than 4,167 cfs. through the Chicago River. The first Court decision against the District in 1923, was followed after further litigation by a ruling by the United States Supreme Court of January 3, 1925.

This decision ruled that any abstraction of waters from the Great Lakes affecting the natural level or flow of boundary waters was prohibited by the international treaty with Great Britain of January, 1909, without the consent of Canada or the United States. As the disposal of sewage through the Sanitary Canal could not be cut off at once, a temporary permit was issued granting the right to divert 8,500 cfs., pending construction of sewage disposal and other remedial works by Chicago.

As set forth in the so-called "Warren Report" of 1919 on "Diversion of Water from the Great Lakes and Niagara River", (3) an average flow of 6,800 cfs. was used in Lockport hydro-electric plant

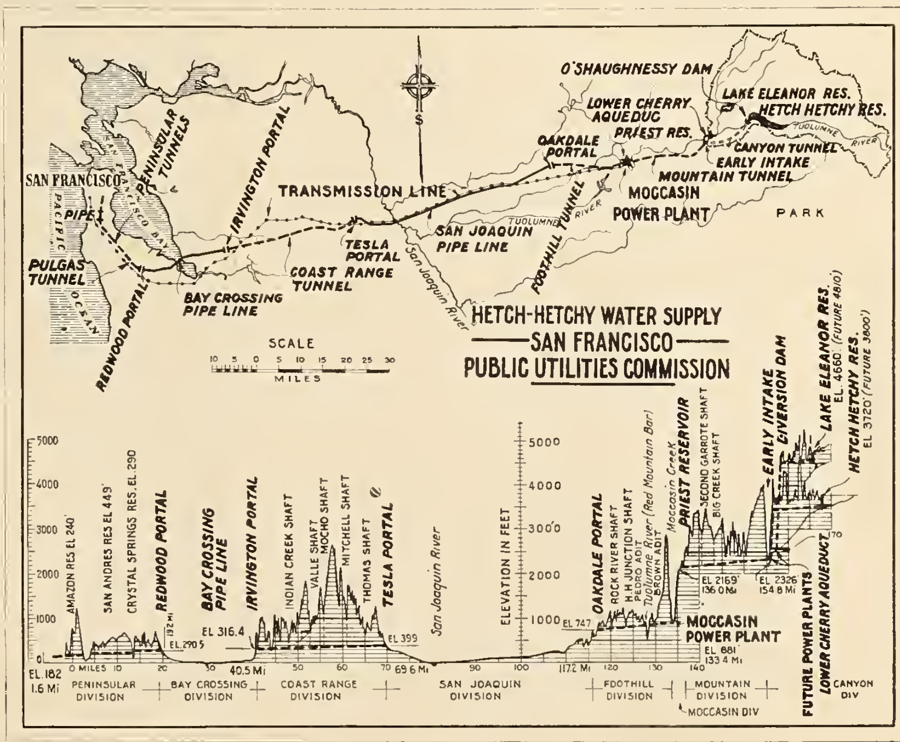


Fig. 1

at the downstream end of the Sanitary Canal (frequently termed Chicago Drainage Canal). By 1939 with the diversion from Lake Michigan reduced to 1,500 cfs., and a domestic pumpage or sewage flow of about 1,700 cfs., the plant at Lockport used an average flow of about 3,010 cfs., a minimum of about 2,400 cfs., and a flood flow of 12,000 to 15,000 cfs. Generation over the last seven years has been about 8,640 kw. The plant at Joliet is now out of service and the Sanitary Canal, aside from its prime purpose and after restriction of diverted flow to present-day levels, makes feasible the generation of approximately 11,000 kw. hydro-electric power.

IRRIGATION

Notable work has been done by the United States Bureau of Reclamation engineers in developing water storage and sources of supply for irrigation projects, particularly in the Southwestern States such as Colorado, Utah, Arizona, etc. Many of these developments involve water diversion from one watershed to another, and some make available hydro-electric power which otherwise could not be developed.

A most interesting instance of diversion serving both power and irrigation purposes is the Potter Valley Project of Pacific Gas and Electric Company. This development comprises the 93,724 acre-ft Lake Pillsbury reservoir on the Eel River; the Van Arsdale diversion dam, some 12 miles downstream from Lake Pillsbury; and a 315 cfs. capacity diversion tunnel to the Potter Valley Power House in the Russian River watershed. A static head of 476.5 ft. is available at the power plant which has an installed capacity of 11,000 kva. Existing limitations in tunnel capacity result in an average maximum output of 6,800 kw., which will increase to 9,200 kw. with removal of tunnel restrictions in the near future. The average output of the plant from 1908 until the completion of Lake Pillsbury in 1921 was about 25 million kwhr. The average output with existing storage is about 50 million kwhr.

From the 1922-3 to 1943-4 water years, inclusive, the flow diverted from the Eel River has averaged 176 cfs. or 32.9 per cent of the average regulated flow. Minimum natural flow is nil. Three years' records show that the diverted flow with a drainage area of 96.9 sq. miles, is 144 per cent of the average natural flow or 59 per cent of the average regulated flow of the Russian River.

Not only does the diversion permit an annual generation of 50 million kwhr. but it provides irrigation water for 5,000 acres in Potter Valley and below, as well as maintaining a uniform flow in the lower reaches of the Russian River, one of the most important recreational areas in Northern California. There are no major hydro-electric developments on Eel River below the diversion and none on the Russian River below Potter Valley power house (4).

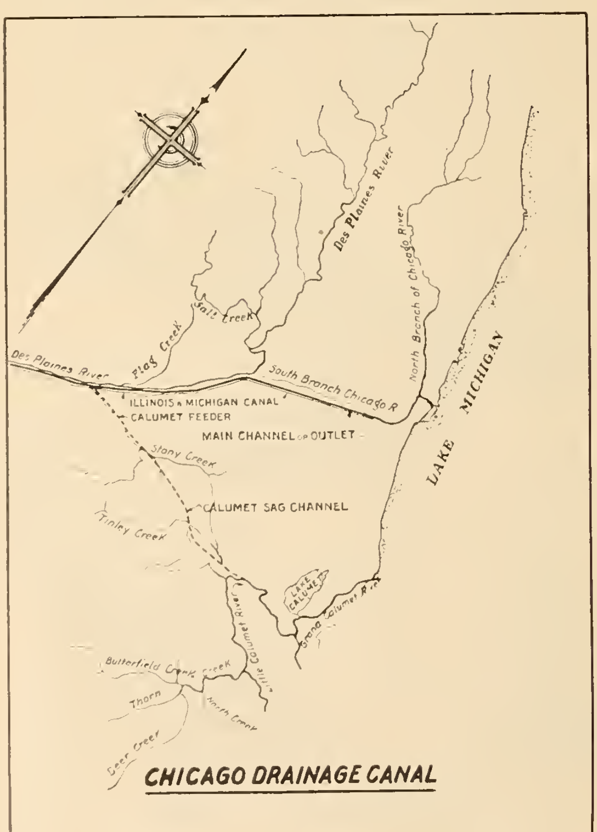


Fig. 2

NAVIGATION CANALS

Navigation canals, in many cases, divert water from one watershed to another, at least in part, for use in the generation of power. The U.S.S.R. has devoted considerable effort to the improvement of internal navigation facilities through the construction of new canals and the betterment of existing canals. One of these provides for the diversion of water from the Don River to the Volga River, a few hundred miles south and east of Moscow. The project of the Trust Hydroenergoprojet (5) provides a dam across the Don below the confluence with the Karpovka River. This dam raises the water level by 205 ft. above the normal river level, and permits diverting to the Volga 424 billion cu. ft. of Don water from the average flow of 767 billion cu. ft. The diverted water flows through the Don-Volga navigation canal. On the Volga River slope of the ridge forming the divide, part of the diverted flow passes through a series of canal locks, the balance of 10,600 to 21,200 cfs. passes through a power plant developing 300,000 kw. before entering the Volga River.

Water Diversions for Power Generation

Water diversions from one watershed to another for power generation fall, as a rule, into two broad categories, viz: low to moderate heads and large flows, or high heads and low flows. Certain developments are somewhat intermediate between these categories, due to unusually favourable circumstances. Diversion developments in the first category are generally found in countries with poorly or only moderately-well defined drainage, and are usually characterized by canals or improved natural waterways for the diversion channels. Developments in the second category occur in mountainous areas with well-defined drainage, and ordinarily involve pressure tunnels as the diversion waterways. Instances of both types are discussed in the following descriptions of power developments dependent on water diversion.

BRAZIL

Brazil, with its area of over three million square miles,—more than half that of South America,—and its population of over 45 millions usually invokes in the average Canadian's mind a picture of steaming jungles in the great Valley of the Amazon. The

Amazon, which has no appreciable water power or population, is not the real Brazil that is rapidly becoming the great industrial country of South America. The real Brazil lies east of the Parana River and between latitudes 20 deg. and 25 deg. south. In this area the cool and healthful climate favours the growth of urban communities and industries, based on the stimulation of hydro-electric developments. Rio de Janeiro, the capital, has a present population of almost 2,000,000. Sao Paulo, with its 1946 population of about 1,750,000, is a great industrial city.

Strange as it may seem, many of the great waterfalls of Brazil are relatively remote from markets and actually tend to delay development of the country by obstructing navigation on the large rivers. All suffer a serious disadvantage from the hydro-electric point of view, due to very high backwater, in the flood season, in the long and narrow canyons downstream. Much of the potential waterpower at visible waterfalls is less significant, economically, than the invisible water powers which can be developed by diversion.[6][7][8] A notable instance of this is the Serra do Cubatao development of the Sao Paulo Tramway Light and Power Company Limited, a unit of Brazilian Traction, Light and Power Company, Limited, the Canadian enterprise which has made such a notable contribution to the development of Brazilian industry.

To visualize the circumstances responsible for Serra do Cubatao it is necessary to consider for a moment the physiography and climate of the area previously mentioned, the real Brazil. Running roughly parallel to the coast, for several hundred miles, and visible from the sea, is the Serra do Mar, apparently a mountain range. Geologically it is a fault or series of faults, as it forms the edge of a great plateau about 2,500 ft. above sea level. Once part of a nearly level lower plain, this plateau when it rose at some remote period of geological change, breaking along these faults parallel to the present coast, developed a gentle tilt towards the interior. The result is that, with few exceptions, the present rivers of this region follow the gentle slope of the plateaus inland until they join the Parana River; they then flow southwest and only join the ocean at the River Plate, over 2,500 miles from their headwaters.

As the slope of the rivers near the Serra do Mar is very gentle, precipitation on the plateau, which is very heavy at the edge, results in sluggish rivers flowing away from the coast towards the interior. On the little-settled narrow low-lying coastal plain the moisture-laden prevailing southeast winds from the Atlantic result in 72 to 84 in. rainfall per year. At the edge of the 2,500 ft. high crest the rainfall is considerably greater, averaging about 192 in. in the vicinity of Serra do Cubatao development and increasing to 270 in. in wet years. Precipitation decreases inland with distance from the edge of the plateau.

Fig. 3 illustrates the Serra do Cubatao hydro-electric development, the conception of which stems from an appreciation of the possibilities inherent in the topography of the area. An investigation in 1924, arising out of curtailment of output of the existing plants of the Sao Paulo Company, as a result of a severe drought, discovered something three earlier investigations had failed to recognize,—that great hydro-electric powers could be effected by diversion.

Careful scrutiny of the contour lines on existing

Fig. 3—Serra do Cubatao hydro electric power development.

official state maps of Sao Paulo showed that a 90 ft. dam on the Tiete River, a few miles below the City of Sao Paulo, would form a lake 106 sq. mi. in area at an elevation of 2408 ft. above sea level, at which elevation the water would flow to the Atlantic through the lowest depression in the almost imperceptible divide at the edge of the plateau and could be developed with a head of 2,380 ft. in the drop to the coastal plain.

However, the simple scheme just discussed would have inundated much of Sao Paulo and destroyed the market for power, so it gave way to the more practical proposal of dams on the main river and tributaries upstream, the reservoirs so created being interconnected through canals or tunnels, and from which the stored water could be drawn for use, as needed, in the power plant at the base of the escarpment.

Further study during the initial construction period indicated it would be advantageous to make a few modifications to this original proposal. The revised development of the project comprises a main reservoir on the Rio Grande with a useful volume of 835,000 acre-ft. at elevation 2,443, equivalent to 1.7 billion kwhr. However, instead of canals and tunnels between the Rio Grande reservoir and the other planned reservoirs, the revised scheme provides one canal through which the available flow of the entire basin of the upper Tiete can be diverted to the main reservoir by two low-head pumping stations offsetting a total difference in level of 40 to 100 ft. This phase of the development assists materially in the reduction of flood hazards to the City of Sao Paulo.

The main or Rio Grande reservoir and the small one serving as a waterway to the crest of the Serra do Mar provide a regulated flow sufficient for 246,000 hp. at 60 per cent load factor. Diversion from the second large reservoir, the Guarapiranga, provides an additional 140,000 hp. Discharge from the Guarapiranga reservoir, built in 1908 to provide regulation for the first hydro-electric plant on the Tiete, flows in the rectified channel of the Rio Grande river and is pumped through 25 to 85 ft. difference of level into the Rio Grande reservoir. An additional 550,000 hp. maximum can be obtained by pumping the flow of the upper Tiete River up the rectified channel of the Pinheiros River through one step of 15 ft. and through the previously-mentioned lift of 25 to 85 ft. into the Rio Grande reservoir. The ultimate capacity of the development will depend on future economic conditions, but it is probable that these will justify nearly 2 million hp., of which 475,000 hp. are now installed.

In brief, the skill of the hydraulic engineer has created a hydro-electric development of over 1,000,000 hp. ultimate capacity by diversion, where Nature provided none.

CANADA

Gaspereau-Avon-Black River Diversion

A notable example of the possibilities inherent in diversions from one watershed to another, where the drainage is poorly defined, is afforded by the diversions into the watershed of the Black River in Nova Scotia, serving the Black River, Hollow Bridge and Lumsden hydro-electric plants of the Avon River Power Company.

The 4,500 hp., 190 ft. head Black River plant is located near the confluence of the Black and Gaspereau Rivers, close to tidewater. The watershed of the Black River proper above the plant has an area of 17 sq. mi., insufficient to warrant the construction of the plant. However, at the time the plant was built, 33 sq. mi. of Avon River watershed was diverted to the Black River by means of a dam and short cut through the divide. Shortly afterwards, 90 sq. mi. of Gaspereau River watershed was diverted by means of the dams and diversion canals (5 miles in length). Thus, 123 sq. mi. of watershed was added to the original 17 sq. mi. of the Black River proper. Two additional plants, the Hollow Bridge and Lumsden stations, and additional storages in the upper portions of the diverted watersheds, were later constructed.

The three plants are operated in conjunction with several other hydro-electric plants and a large steam station in the city of Halifax, so as to utilize maximum energy from available water resources. Annual generation over the last three years has been about 72 million kwhr.(9)

OGOKI DIVERSION

The Ogoki diversion (10) of the Hydro-Electric Power Commission of Ontario is of the same general type as the Gaspereau-Avon-Black River diversions, but on a far wider scale, in that 5,545 sq. mi. of the Albany River watershed, draining into James Bay and via Hudson Bay to the Atlantic, is diverted via Lake Nipigon into the Great Lakes-St. Lawrence River watershed.

Fig. 4 shows the scheme of development which makes the Ogoki diversion feasible. The diversion project consists essentially of a concrete diversion dam at Waboose rapids on the Ogoki river, a tributary of the Albany River which empties into James Bay. This dam raises the water level in the Ogoki River about 40 ft. and floods back to the divide where a short cut about 80 ft. wide and 15 ft. deep through the low gravel ridge permits the water, after passing the Summit concrete control dam, to find its way through a series of lakes into the Jackfish River and thence Lake Nipigon. It is interesting to note the diversion canal entailed only about 50,000 cu. yd. excavation, almost entirely through gravel and muskeg. The Waboose diversion dam is designed to spill crest flood flows which cannot be stored in the 400,000 acre-ft. reservoir created by the dam.

Actual construction was begun in December 1940 and water was first diverted through the control dam in July, 1943. This undertaking made feasible, by agreement with the United States, the utilization of additional flow at Niagara in the fall of 1940, when Canada was directing every effort to prosecution of the war.

Costing somewhat less than $5 millions, the Ogoki diversion carries an average flow of 4,000 cfs. and up to 10,000 cfs. at times, which can be utilized at:

On the Nipigon River—	
Cameron and Alexander Plants	135 ft. head
Undeveloped	105 ft. head
St. Mary's River (Approx.)	20 ft. head
Niagara River	315 ft. head
International Section of St. Lawrence	85 ft. head
St. Lawrence, below International Section to Montreal	135 ft. head

LONG LAKE DIVERSION

The Long Lake diversion development (11) (12) of the Hydro-Electric Power Commission of Ontario, also shown by Fig. 4, provides for diverting an average flow of about 1000 cfs. from the Kenogami river watershed, which normally flows via the Kenogami and Albany rivers into James Bay, to Lake Superior and the Great Lakes-St. Lawrence river system. This development entails two concrete dams and a diversion channel 5.5 miles long. The diversion is primarily effected by a dam across the Kenogami river 15 miles north of Long Lake, a channel excavated through the height of land to the head of the Aquasabon river and a control dam 5.5 miles south of Long Lake.

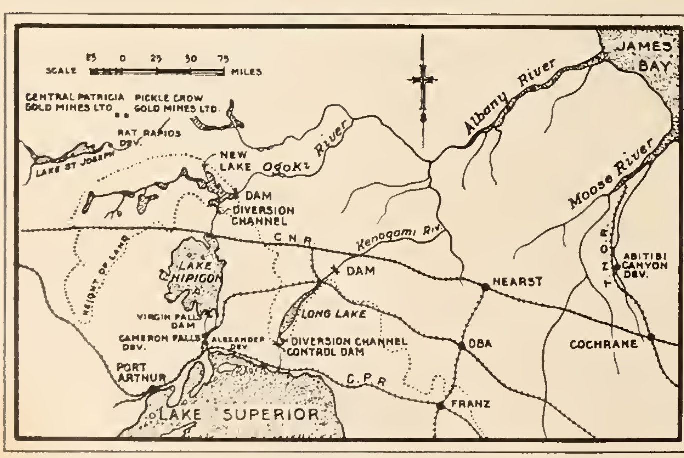
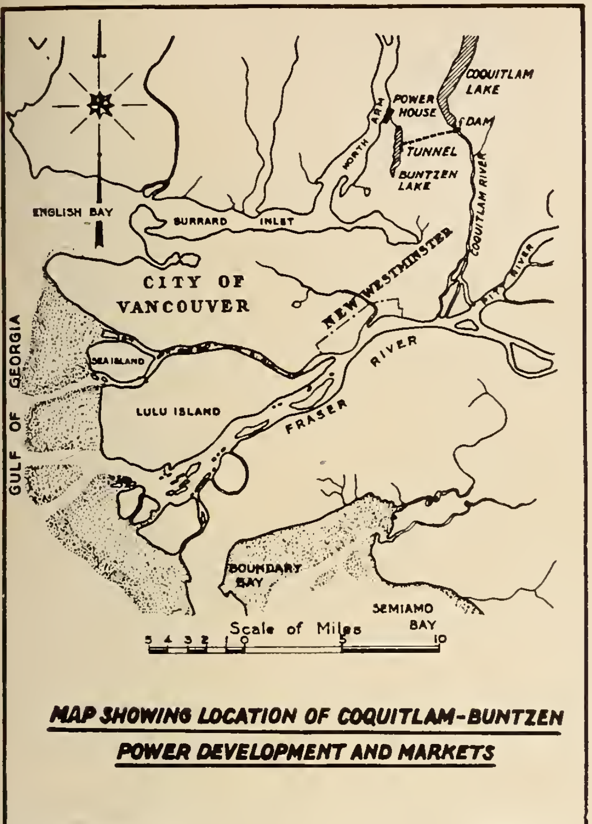


Fig. 4—Map showing location of Ogoki and Long Lake diversions.

The two dams control a drainage area of 1,630 sq. mi., including a storage area of 53 sq. mi. in Long Lake, the level of which may be varied from ordinary maximum level at 1028.4 G.S.C. to ordinary minimum level at 1020.0 G.S.C., providing about 287,300 acre-ft. of storage. Commenced in July, 1937, the project was completed within two years at a total cost of approximately $1,270,000.

It is estimated the water made available by the two diversions, at a total cost of approximately $6,270,000, will provide some 320,000 hp. continuously at developed and undeveloped power sites in Ontario. In addition the potential energy resources of the St. Lawrence river in Quebec are increased by approximately 50,000 continuous hp. The Ogoki diversion, by improving the dependable flow of the Nipigon river, enables the production of an additional 36,000 continuous hp. at the Alexander and Cameron Falls plants on the Nipigon. The di-



MAP SHOWING LOCATION OF COQUITLAM-BUNTZEN POWER DEVELOPMENT AND MARKETS

Fig. 5

verted waters enable the generation of 70,000 continuous hp. at the new DeCew Falls plant near St. Catharines and an additional 25,000 firm hp. at existing Niagara river generating stations.

These diversions thus strikingly emphasize a feature inherent in most hydro-electric developments. That is, within reasonable limits, additional flow from diversion or storage will permit generation of additional energy at a cost considerably below the average cost prior to use of such additional flow. Ordinarily, the costs of the works and structures in a hydro-electric development, especially of low to moderate head, are affected to a minor degree only by the flow utilized for production of energy.

COQUITLAM-BUNTZEN POWER DEVELOPMENT

One of the earliest major water diversions for hydro-electric power in Canada was the Coquitlam-Buntzen development of the Vancouver Power Company, Limited, a subsidiary of the British Columbia Electric Railway Company. (13)(14) Fig. 5 illustrates the location of the development relative to the market, at Canada's rapidly-growing Pacific Coast seaport of Vancouver and New Westminster. Lake Coquitlam, the main storage, has a heavily-timbered watershed covering a mountainous area of about 105 sq. miles, with an annual precipitation of over 145 in. A hydraulic-fill dam, with a maximum height of 100 ft., impounds 180,500 acre-ft. of water.

By diverting water from Lake Coquitlam through a 2.4 mile tunnel to Lake Buntzen, where it is impounded by a concrete dam 54 ft. high, and thence to the power houses, a 64,000 hp. installed capacity at a static head of 400 ft. was made economically feasible.

ALOUETTE-STAVE FALLS-RUSKIN

The Alouette Lakes lie in a narrow valley some 8 miles north of the Fraser River, about 25 miles due east of Vancouver. There are really two lakes separated by a short reach of stream at low water. By damming the outlet and piercing the narrow ridge between Alouette and Stave Lakes with a tunnel, the regulated and diverted waters of the Alouette pass through the Alouette automatic hydro-electric generating station at the tunnel outlet on Stave Lake. This station comprises a vertical Francis waterwheel developing 12,500 hp. under 125.5 ft. net effective head. Thence the average annual diverted flow of some 700 cfs., about 90.2 per cent of the mean available from the Alouette watershed, passes through the Stave Falls and Ruskin generating plants of 79,000 hp. installed capacity at 130 ft. static head and 188,000 hp. ultimate capacity at 125 ft. static head, respectively.

BRIDGE RIVER DEVELOPMENT

The Bridge River hydro-electric development of the British Columbia Electric Railway Company, Limited, now under construction, is a particularly notable instance of what can be accomplished by diversion of water from one watershed to another, under favourable conditions. Figure 6 shows the relationship of the project to the market served,—Vancouver, about 130 miles transmission distance southwest.

Bridge River, one of the principal western tributaries of the Fraser, originates on the eastern slopes of the Coast Range, rising from 6,000 to 10,000 ft. above sea level in rugged snow and glacier-clad peaks. A typical mountain river in its upper reaches, its heavy load of glacial detritus is deposited in the long flat valley basins of the meandering middle

LOCATION MAP SHOWING LOCATION OF BRIDGE RIVER-SETON LAKE DIVERSION POWER DEVELOPMENT & MARKETS

Fig. 6

reaches, prior to the 1400 ft. plunge in a series of rapids and falls through the deep canyon by which it gains the Fraser.

Run-off from the 1,350 sq. mi. watershed is chiefly derived from the higher levels, where precipitation, mostly in the form of snow, is higher than on the semi-arid lower levels. In general, the slopes and benches are moderately forested, with yellow pine predominating. Precipitation of approximately 18 to 20 inches on the lower levels, together with that derived from melting snowfields and glaciers, results in a mean annual yield of 3,736 cfs., for 15 years of record, during which period the mean annual flood was 17,750 cfs. and the maximum 26,000 cfs.

There is a total of four feasible storage reservoirs for the project, with a total capacity of 1,293,000 acre-ft., estimated sufficient for a continuous flow for power generation of 3,000 cfs., 80 per cent of the mean discharge. Where the Bridge River bends southward, before its final downward burst to the Fraser, its bed is less than 3 miles from Lake Seton, lying parallel to the Bridge River, and emptying into the Fraser via Seton Creek. Now Seton Lake lies some 1,210 ft. below the Bridge River bed, from which it is separated by Mission Mountain. Consequently, the economical solution lies in a diversion dam on Bridge River at the lower end of the sluggish middle reaches, a 13,200 ft. tunnel through Mission Mountain with intake, surge chamber, penstock tunnel and outlet structure, penstocks and power station on Seton Lake.

Diversion here makes feasible a 600,000 hp. development at an average effective head of 1,300 ft. The diversion scheme of development is particularly appropriate in that the Pacific Great Eastern Railway passes the site of the generating station, a significant consideration in the mountainous terrain of the development.(16)(17)

EGYPT

An unique scheme for development of hydro-electric power, where none exists naturally, has been put forward in Egypt recently. (18) The Quattara Depression, on which General Montgomery hinged his left flank when the famous Eighth Army struck the blow at Rommel's Afrika Korps before El Alamein, lies as much as 400 ft. below sea level. It has an area of 4,500,000 acres, equal to one-half the present habitable area of Egypt or an area roughly equal to the State of New Jersey.

By taking water from the Mediterranean through a 12 mile channel and a 28 mile tunnel to Quattara, it would be possible to fill the depression to a level about 150 ft. below the Mediterranean and have a head of 120 ft. available. Natural evaporation would remove the water as fast as it entered the depression. It is estimated about 170,000 hp. could be generated, at a construction cost of about $75 millions. Despite the high cost of about $450 per horsepower, the scheme has definite attractions in power-poor Egypt, especially in view of its anticipated effect on climate over a large area of waterless desert.

GREAT BRITAIN

Even in countries which are highly-developed industrially and support a large population, there are opportunities for diversion of water from one watershed to another for the generation of more power or more economical generation than is otherwise feasible. Such an instance is the Lochaber hydro-electric development (19) (20) of the British Aluminum Company in Scotland, where waters of the River Spey in excess of requirements in the watershed of origin, are diverted across the divide to be used in the production of energy for the smelting of aluminum.

The watershed of the Lochaber power development comprises 303 sq. mi. Precipitation is at a maximum in the vicinity of Ben Nevis on the west and a minimum on the easterly portion of the watershed. Lochs Laggan and Treig are the principal reservoirs. They are connected by a tunnel 2.75 miles long, 15 ft. in diameter. Loch Laggan has been extended by dredging the outlet and building a dam 130 ft. high and 700 ft. long across the Spean River 4.5 miles below the loch. Although the existing high-water level of the loch has not been raised, its waters may be drawn 16 ft., thus providing 1.48 billion cu. ft. storage. Loch Treig has been raised 35 ft. by a dam across the River Treig. Its waters can be drawn down a total of 124 ft., providing 7.838 billion cu. ft. storage.

In addition to the run-off from the natural watershed, the flood waters of the River Spey, in excess of 40 million Imp. gpd., are diverted through a diversion conduit with a capacity of 1,600 cfs. A subsidiary conduit diverts the water of the Mashie River, itself a tributary of the Spey. From Loch Treig a 15 mile pressure tunnel, of mean diameter of 15 ft. 2 in., conveys the water to the penstocks. From the powerhouse, a 3,200 ft. long tailrace discharges the water into the River Lochy.

Eleven important streams are tapped along the route of the main tunnel, the water entering the tunnel through vertical shafts. Owing to the high precipitation on the slopes of Ben Nevis, the yield from the tapped streams accounts for 16 per cent of the total power available. During periods of heavy rainfall these tapped streams furnish more water than required for power, the excess flowing up the tunnel for storage in Loch Treig. With Loch Treig full, the gross head on the impulse turbine nozzles is 800 ft. This head and the diversions permit developing a maximum capacity of 120,000 hp., the highest in Scotland.

INDIA

The hydro-electric development of the great Indian industrial firm of Tata Bros., in the Western Ghats, about 40 miles from the growing manufacturing city and seaport of Bombay, is an example of how diversion of water from one watershed to another has made feasible the development of a sizeable block of power, where little or none could be developed by the more customary method of head concentration on the waterway of origin.

The Bombay Hills or Western Ghats rise to an altitude of 2000-3000 ft. above sea level, sloping steeply to the sea on the westerly side, so that streams are short and have little potential power capacity. On the easterly side slopes are gentle, so that there is little head available. However, the Shirawta and Walwhan storages on the easterly slope, created by masonry dams, have a capacity of 10.1 billion cu. ft. Their catchment area is 16.5 sq. mi. These lakes, at elevations of 2162 and 2084 above sea level respectively, feed through a tunnel the Lonawla Monsoon Lake — at elevation 2052. Lonawla storage was capable of being developed sufficiently to provide about 14 days supply of water, and serves merely to smooth out the inequalities of the daily monsoon rainfall, which lasts for somewhat more than 3 months. The southwest monsoon rainfall is very variable, and may range from 80 to 100 inches in relatively dry years to 500 inches or more in years of high rainfall. The storage provides the necessary water during the non-monsoon period of about 9 months, which requires 6.7 billion cu. ft. The excess storage takes care of dry years.

A 2 mile canal leads from the "Monsoon Lake" to the forebay created by damming a narrow valley, whence a 12,520 ft. long pipe-line descends 1,725 ft., through a gap in the hills, to the 100,000 hp. power plant at the western foot of the Ghats. [21] [22] Net head on the turbines is 1,659 ft. at full load, with gross head 1,725 ft. The turbines are Pelton-type impulse units, rated 11,000 hp., with a maximum capacity of 13,500 hp.

KOREA

In 1926, the Japanese started a 260,000 hp. hydro-electric development near the northern border of Korea (Chosen). This project was undertaken to supply power for the annual production of about 300,000 tons of nitrogenous fertilizer at a site about 38 miles transmission distance from the power stations. The development is notable for its power possibilities and the high head in the first plant, as well as for the 16.65 mile concrete-lined tunnel, required to effect diversion of the waters of the Fusenko River.

The Fusenko River, a tributary of the Yao-Lu or Oryokuku River, rises in a range of mountains 5,000 to 6,000 ft. high and runs some 100 miles to its confluence with the Yao-Lu. The Fusenko River is dammed at a gorge about 25 miles north of the crest line of the mountains by a 250 ft. concrete gravity dam of the overflow type, which impounds about 25 billion cu. ft. of water. By utilizing 15 billion cu. ft. of storage water, a constant flow of 825 cfs. can be obtained. By taking this flow through the intake and tunnel to the southern or Japan Sea side of the mountain ridge it is possible to obtain a constant generation of 260,000 hp.

On the steep southern slope of the mountains three steps of waterway and power stations are comprised in the scheme. The waterwheels in the first stage, with an effective head of 2,355 ft., are horizontal impulse units rated 45,000 hp., driving 36,000 kva. generators. Cost of the first stage was estimated at $17 millions and for the complete project $22 millions or about $85 per hp.[23]

NEWFOUNDLAND

An interesting example of how hydro-electric developments can be literally "made" by diversion of water from one watershed to another is afforded by the Tors Cove and Rocky Pond developments of the Newfoundland Light and Power Co. [24] See Fig. 7. The Tors Cove plant is situated at the foot of the Tors Cove Brook watershed with an area of 14 sq. mi. Present installation is 5,700 hp. at 173 ft. head, with provision for a third unit which will increase the capacity to about 9,000 hp. The Rocky Pond plant is at the upper end of the Tors Cove Brook watershed with no appreciable natural drainage area. It has an installed capacity of 4,200 hp. at 107 ft. head.

Tors Cove Brook originally had a regulated flow of 42 cfs. from its 14 sq. mi. watershed, and its 9,450 acre-feet developed storage. Coincident with the construction of Tors Cove plant, the run-off from 24 sq. miles of Little Harbour watershed was diverted into the La Manche River watershed by means of a canal

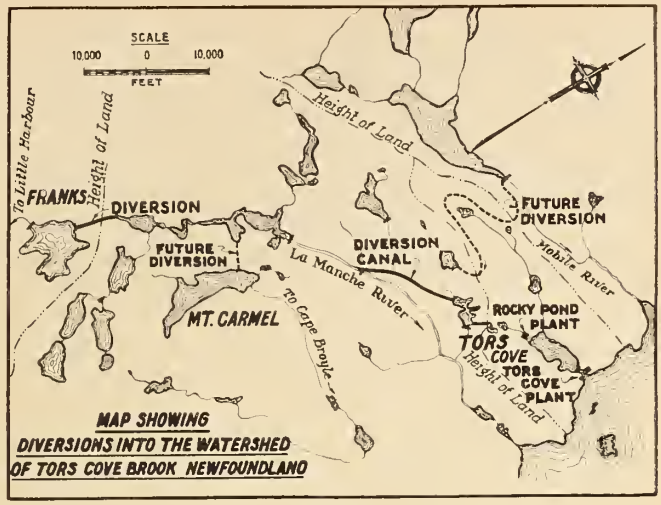


Fig. 7

one mile long, in addition to which the run-off from 44 sq. miles of La Manche River watershed was turned into the Tors Cove waterway above Rocky Pond plant through a 3.5 mile canal. The diverted regulated flow from the Little Harbour and La Manche River watersheds is estimated at 140 cfs., or 3.33 times that from Tors Cove Brook alone.

In brief, these diversions mean that Tors Cove plant now has the run-off from 82 sq. mi. of watershed in place of the original 14 sq. mi. and a developed storage of 42,700 acre-ft. as compared with 9,450 acre-ft. Rocky Pond plant now has the run-off from 69 sq. mi. of watershed in place of the natural 1 sq. mile and a developed storage of 33,250 acre-ft. Two additional diversions are contemplated, both of which will supply Tors Cove and Rocky Pond plants. These comprise 40 sq. mi. of Mobile River watershed and 20,000 acre-ft. of storage, and 13 sq. mi. of Cape Broyle watershed with 20,000 acre-ft. of storage.

The significance of the diversions on this hydro-electric development will be appreciated from the fact that the diversions actually effected increased the estimated firm-power energy generation of Tors Cove plant from 3.6 million kwhr. to 17 million kwhr., and increased that of Rocky Pond plant from nil to 9 million kwhr., a total estimated gain of 22.4 million kwhr.

NORWAY

Norway, like British Columbia and the region of Brazil described earlier, is endowed with abundant water power resources, most of which are relatively high head. Norway, broadly speaking, is a country of very rugged terrain, most of which lies between 2,000 and 3,000 feet above sea level in an undulating plateau, with a number of higher mountain ridges. Numerous lakes occur on the plateau, the drainage from which finds its way through deep gorge-like valleys to the many deep-water arms of the sea or fjords which enter far inland from the general coast line. Although the rivers are not long, abundant precipitation and good storage possibilities in the head-water lakes, combined with high head, make for low-cost power developments, the output of which is utilized primarily for industry, although general domestic service for homes is increasing in importance. It is noteworthy that Oslo is proceeding with complete electrification of homes in that city. A small part of the total energy output is used in agriculture. Industrial developments and settlements are located in the broader valley basins near and around the shores of fjords and elsewhere.

As a result of these favourable conditions, Norway is one of the few countries where "visible" power developments can be made at a cost so low that most of Canada's so-called "cheap waterpower" seems high-priced, by comparison. However, developments of that type which have not yet been constructed are located in such generally inaccessible areas that for many years to come they will not be feasibly utilizable for general public service. In fact, they will probably be developed only when and if some large electro-chemical industry is forced by increase in power costs in the more populous areas to move on in quest of cheaper power.

So far as known, no major diversions of water from one watershed to another, for power generation, have as yet been made in Norway, for the reasons just described. However, some relatively small diversions have been constructed, as the cost of diversions on the high plateau is relatively low, and the discharge of developed rivers is not high. Moreover, interest in major diversions is mounting and the near future will, no doubt, see a number of these effected.

SWITZERLAND

Switzerland is endowed with rich waterpower resources but no coal or oil, and relatively little forest. Its industry and railway systems rely on hydro-electric energy, which is also extensively used in the home. Consequently, much of the visible and invisible water power has been developed. The Swiss have proven themselves very conscious of the valuable invisible water-power resources which can be brought into being by diversion of water from one watershed to another, where it can be utilized at a higher head. Despite difficulties inherent in racial groupings and the cantonal arrangement of political subdivisions, many diversions have been put into service, the prime consideration being the over-all national economy.

Switzerland is characterized by the high rugged Alps with their snow fields and glaciers on the higher levels, and intervening valleys with their settlements and industries. The Alps, of course, are the breeding ground of many of the great rivers of Europe, such as the Rhone, the Rhine, the Danube, the Po and the Adige. Precipitation is variable. Markets are not always easily accessible by transmission lines from power developments of the usual run-of-river and storage types. Moreover, such plants are frequently not capable of developing the same power from available water as if the water were diverted to an adjoining valley where a higher head can be utilized.

Broadly speaking, run-off is low during the winter months when the need for power is greatest. Consequently, storage of summer run-off for use during the winter at the highest feasible head characterizes many Swiss power developments. Not infrequently pumping is resorted to during summer months to increase storage available for the winter period, and sometimes secure a greater energy output by diversion through a higher-head development.

One example is the Ritom plant. Waters of the Cadlimo stream, which normally flow into the Rhine and empty into the North Sea, have been diverted into Lake Ritom whence they find their way through several power plants and the Tessin River to the River Po, emptying into the Adriatic Sea.

LUCENDRO POWER DEVELOPMENT

The Lucendro power development (25) (26) started in 1942 and just placed in operation, is a good example of a waterpower made practical by diversion. Lucendro Lake, with a natural watershed of 2.7 sq. mi., normally drains into the Rhine. However, the head available for power development on its natural outlet is not well concentrated and is far less than that which can be made available by diversion towards the southeast, to Airolo on the Tessin River. Sella Lake, which empties by way of the Tremola into the Tessin and finally the Po River, has a natural watershed of 2.3 sq. mi. An additional 3.9 sq. mi. is obtained by leading in side streams artificially, thus making the run-off from 8.9 sq. mi. usable.

By raising the level of Lake Lucendro about 196.9 ft., a storage of 883 million cu. ft. capacity is obtained. Raising Lake Sella 105 ft. yields another 318 million cu. ft. Annual depth of run-off from the watershed is about 7.38 ft., so that a total of 1.819 billion cu. ft. results, of which 1.649 billion cu. ft. is available for energy generation, on the average. The rate of usage of water in the power plant is fixed by the primary purpose of the development, the generation of maximum winter energy, 212 cfs., which is the designed capacity of the tunnel and penstock lines. Used under a gross head of 3266 ft. in the Airolo power plant, this flow results in an output of 66,000 hp. for about 1,700 hours.

After discharge from the new Airolo power station, the water is again used with 1088 ft. and 912 ft. heads at Pottino and Biaschina plants respectively, which are located on the Tessin. Total winter energy output of the Lucendro project is placed at 78 million kwhr., while an additional 37 million kwhr. is derived from the Pottino and Biaschina plants.

UNITED STATES

There are a number of diversions from one watershed to another in the United States, for the purpose of power generation, where hydraulic engineers have made full use of the possibilities inherent in the topography of the area to obtain the invisible waterpower otherwise wasted. Space will not permit describing these in detail but it may be said practically all are located in the rugged Western States. One fine example is that of the power developments of the Pacific Gas and Electric Company on the watersheds of the Yuba, Bear and American Rivers. (27)

General Aspects of Water Diversion for Power Generation

An important factor relative to diversion of water from one watershed for use in the power plants of another watershed is the greater use factor obtained from existing developments. Most hydro-electric developments entail hydraulic structures adequate for the passage of flood discharges far in excess of the useful regulated flow utilized during the greater part of the year. Hence, it is easy to accommodate additional regulated flow without further expense for non-productive facilities, such as dams, in the existing plants.

Diversions are not necessarily permanent. Provision can be, and usually is, made for the passage of water needed in the waterway from which the diversion is taken, as well as for allowing the passage of flood flows down the natural outlet. Diversions from undeveloped watersheds frequently contribute to the development of the tributary area below the point of diversion by providing a means of regulating the flow, thus permitting far easier and cheaper logging operations. In addition, the generation of more power in a developed watershed or valley inevitably has a beneficial effect on the economy of the area and the country as a whole.

DIVERSION POSSIBILITIES IN QUEBEC

Anyone who has studied a map of Quebec will appreciate that its principal rivers empty into the Ottawa-St. Lawrence Rivers, the Gulf of St. Lawrence, James and Hudson Bays, and Ungava Bay. All these rivers have their headwaters in the Laurentian Plateau, where the divisions between watersheds are, in many cases, very indistinct and easily pierced by short diversion canals. Drainage of this plateau is very intricate and generally speaking disorganized. This is emphasized by an examination of a good relief map and particularly by ground and aerial exploration.

Although Quebec leads in water power development, no diversions have been made in the province as yet. This is because the plentiful " visible " power resources have been ample to take care of needs up to the present, but with industrialization rapidly taking place and the advancing price of coal, of which none is found in Quebec, it is to be expected that diversions of the low-head type, providing additional volume of flow, may be utilized to good advantage.

SUMMARY

It has been shown that it is not always the visible waterpowers of a country which are the economical sources of hydro-electric energy. Instances have been drawn from developments and projects in Brazil, Canada other than Quebec, Egypt, Great Britain, India, Korea, Newfoundland, Switzerland and the United States where great power developments are based on the " invisible " waterpowers associated with diversion of water from one watershed to another.

Such diversions not only improve the development of the area of the watershed to which the diversion is made, but tend also to facilitate development of the area of the watershed from which the diversion is made. True, in many cases, the watershed from which the diversion is taken will not be exploited and opened up to industry for many years, if ever. Why then allow the " white coal " running down the rivers to the sea to be wasted? Why not utilize it for the common good of the community? No rights are destroyed in the process. Only that which is running to waste, never to be reclaimed, is utilized.

Experience in hydro-electric power development has amply demonstrated the parable of the buried talent. The time to develop a water power, and particularly a diversion, is as soon as possible. Every delay not only increases the cost of making the development but also increases the interference due to the claims of other parties that their rights are being invaded. If the delay is long enough, then due to the actual construction of private and public works which conflict with the plans for the development, the result is that the cost of materialization becomes so great that it is uneconomical to proceed and the opportunity to create the power is lost. On the other hand, if the job had been tackled earlier, the private and public works instead of interfering could have proceeded equally well and probably even more rapidly as one of the results of the power developed.

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EXPORT TRADING—CANADA'S HIGHWAY TO PROSPERITY

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An address delivered before the Junior section of the Montreal Branch of The Engineering Institute of Canada on April 7th, 1947.

This article should be of special interest to production and sales engineers. The author measures the vast potential foreign market against our domestic market. He lists our main export items and tells what proportions various countries take. Income per capita from exports is compared with that of Britain and the U.S. Pointing to the importance of foreign trade when domestic trade slackens off, he shows that export opportunities are not limited by export credits. Some valuable trading principles are given, as well as good advice from the Department of Trade and Commerce. The cost of strikes in terms of lost exports is assessed, and the value of the Exporters Association to foreign traders is explained. Every manufacturer, he believes, should be an exporter.

In lining up any sales programme for any kind of product, we must keep in our mental frontyards the fact that in Canada we have only slightly more than ½ of one per cent of the world's population to whom we may sell our materials, and that accordingly a very much larger market for us all should lie amongst the remaining 99 per cent of the world's population, who do not enjoy the privilege of living in this great country. Trade horizons are something for Canadian Manufacturers to constantly and continuously strive to roll back.

From the economic standpoint alone, Canada is one of the least self-sufficient of all the countries in the world. This is brought about largely by our present tremendously increased capacities for production, and our limited home market due to our small population. To be as successful as we might be, the two sales horses, home market sales and export market sales, should be hitched up to pull in double harness.

Our Exports and Where They Go

In these days of golden trade opportunity, Canada's export business is booming. Reports just released from Ottawa show that our foreign trade during the record peacetime year of 1946 was somewhat more than 2½ times greater in dollar value than it was in the year 1939. The decrease of some $900 millions from the figures of 1945 is due to the elimination of over a billion dollars worth of war materials from the list of our exports during 1946. Last year we shipped 38½ per cent of our total exports to the United States; a further 26 per cent went to the United Kingdom, and another 13 per cent to other British Commonwealth Countries, thus a total of 77½ per cent of our exports went to these three countries. Products which made up the bulk of our export shipments for last year, in order of dollar value, are as follows: newsprint, wheat, wheat flour, planks and boards, wood pulp, fish, autos, trucks and parts thereof, bacon and ham, aluminum, and nickel.

Opportunities for the expansion of Canada's Foreign Trade lie chiefly in countries outside the United Kingdom and the United States. It would be greatly to our benefit to anchor our export business more securely, by putting further solid foundations under it in a great many countries as well, as we are proceeding to do with such success in Latin American countries. In 1946, we sold $93 millions worth of Canada's goods to Latin America, as compared with about half that figure for 1945. We can rely on Latin American countries for a further great expansion of trading.

Importance of Our Foreign Trade

Canada can never have too much foreign trade! Should our foreign trade shorten, our unemployment lines are bound to lengthen. As a people, we are not nearly as foreign-trade minded as we should be. This is perhaps largely because of the fact that the United States and Britain have always taken such a large percentage of our shipments abroad. There has never been a period of prosperity in Canada which was not associated with a high volume of international trade. To put this statement to you more clearly in another way—if Canada had not done any export business at all during the past 20 years, this country would actually have suffered annually a reduction of some 27 per cent in its national income.

The importance of Canada's export trade to each one of us is clearly highlighted by the fact that 35 cents out of every dollar you and I receive comes from Canada's trade abroad. In that sense, all of us are already in the export business, and any foreign buyer is just as much a customer of yours as if you were dealing with him personally. One third of all the dollars each one of us receives may be said to come from Patagonia, or Peru, or Poland, of Timbuctoo.

In the United States, with its 130 million people, the comparable figure is less than 7 cents out of every dollar. Even in stout and courageous Britain, who since the war has laid such emphatic and tremendous emphasis upon her export endeavours—through her " Export or Perish " Campaign, the pre-war figure was only 20 cents out of every dollar. Before the war it was the general plan of British manufacturers to allocate approximately 60 per cent of their production for export and 40 per cent for the home market. As of today, Britain has upped her pre-war export figures in value by about 75 per cent. Canada's exports last year were only approximately $3 millions per day in value less than the exports of Great Britain. Canada emerged from the war the second largest trading nation in the world, and is today only exceeded by the United States and Great Britain.

More Immigration Needed

These figures which I have given you, showing our dependence upon the volume of our export trading, bring also into clearer focus the all-important need of a long-term selective immigration policy for Canada, which would boost our present small population of only 12 million people. It is particularly gratifying to note from recent advices from Ottawa that Canada has now formulated, and entered upon, a plan to better this condition. While under this new immigration "Order-In-Council", Canada will not be opening her doors widely to immigrants, it should serve to encourage a goodly number to come to this country. It is devoutly to be hoped that this new plan produces the desired results.

More Exports When Domestic Demand Slackens

No manufacturer of any kind of commodity in this country can fail to take cognizance of the position of his business over the run of the years that lie directly ahead, without giving most careful consideration to his sales position in the export field. The present domestic sales honeymoon will not last much longer. It is true that the industrial strikes we have had have prolonged the seller's market by at least 6 months. The tide is already turning however, and we are today at least ankle-deep in more competitive going in many lines of merchandise, and the water gets deeper each month.

The extension of foreign trading for this Dominion is a top objective, and one to which any company may well devote its wholehearted efforts, knowing that it is a business opportunity which is both profitable and patriotic as well. I say " profitable " because trading does not normally take place unless it is a good thing for both sides. Without a goodly export trade, our industrial system cannot operate efficiently or to capacity. Our continued prosperity must be through constantly greater and greater production, marketed in broader and broader fields. It is to our definite advantage to be more internationally-minded in our sales thinking, and to devote as much effort, care and research to developing markets abroad, as we are giving to our market at home.

The need to advance Canada's exports is certainly one of the most urgent problems confronting the country. To the extent that we solve that problem, so will our people be employed and our well-being increase. Provided we can keep our industries, our mines, and our farms actively producing, and keep the prices of the materials they produce within the reach of consumers, both at home and abroad, we can face the future confidently.

Exports Not Solely Dependent on Credits

One cannot escape the feeling that the export market offers a far brighter prospect than one would believe, from its neglect in favour of the presently lush domestic market by some of us. A part of this neglect seems due to the feeling that foreign demands depend in large part upon Canada's loans to certain other countries, and that these demands may fold up when the loans run out. More of the neglect however, seems due to the apparent conviction of too many business men that they can gain, or regain, foreign markets whenever they may decide they want to go after them in earnest. Perhaps later on, maybe in a year or so, they may be ready.

There is this to be said at least, to those who expect the foreign supply of dollars to dry up when Canada's loans to such countries run out. Last year, outside of shipments to Britain, less than 12 per cent of our total export sales went to the 8 other countries in receipt of loans from us. Furthermore, it may very well come about that by the time the loans run out, (and only 46 per cent of the $1,845 millions had at January 1st been advanced to them), some of those countries may themselves then be selling to Canada or to the United States many of their own goods, for which they will be receiving a supply of Canadian or American dollars, to enable them to continue their purchases from us. Foreign trading is definitely a two-way thoroughfare.

It is not to be forgotten either, in this same connection, that profitable cash business is being transacted every day by us in many other countries to whom Canada has not extended any loans. We must also not overlook that an extremely large volume of successful export business is daily being safely consummated through the use of Canada's Export Credits Insurance Plan. Those who count on picking off foreign markets some time or other, when they may get around to it, are in for some rude shocks. The notion that we can move into foreign fields whenever it may suit our fancy has, I fear, a very shallow foundation, indeed.

Low production costs enable us to secure more customers. More customers produce more jobs, and the kind of customers I am talking about live abroad! They do not care one iota about our living standards in Canada, but they do care greatly about the quality and the price tags we put on the goods that we sell them. Our Federal Department of Trade & Commerce, an outstandingly efficient governmental department—is not much troubled these days, I'm sure, about domestic trade within Canada. Most of its real or important problems lie in the field of trading abroad. It is in that field that the economy, or as I prefer to phrase it the " well-being ", of Canada and all our people, stands to suffer most heavily if a world wide depression develops.

Some Trading Rules for Exporters

May I, at this point, emphasize certain practical work-a-day trading principles, — shirt-sleeve principles as it were, which must be observed if Canada is to win out in competition with all comers in the markets of the World. The first of these is: *Canada Can Make the Best!* Let the world know that fact through the quality of the products we send them. Foreign markets are not generally interested in goods of inferior or shoddy make-up, so do not commit the error of promoting that class of merchandise to them. Good quality, like good character, is of enduring value. Secondly, study the requirements of the countries which you consider you are in the best position to serve. Challenge these first of all, later taking on further commitments in other lands as your supply position improves.

Now, I am sure that I do not need to stress the point that a foreign customer will, in the last analysis, purchase just exactly the kind of goods *he* wants. Your product, as made for your Canadian customer, may therefore, need some re-designing, or re-styling or re-packaging, in order to fill the particular needs of the Nicaraguan, or the west Indian or the Brazilian. In most cases it is usually very much worth-while to shove over, and earnestly endeavour to meet those special requirements, rather than to stand or fall on a product made in such a manner that it does not completely fill the prospect's needs.

A case of this sort came to my attention recently; a certain Canadian company was shipping salt in bags to Nigeria. They sewed up the top of their bag with strings, and then sealed the strings with a small leaden seal such as is used on freight car doors. The natives liked this package and its contents, and purchased it freely. It was a long time before the manufacturers of competing materials found out that the natives' predilection for that particular product was the fact that they found a very important use for the lead plug as a sinker on their fishing lines.

As another example, the Newfoundlander desires to purchase his roll roofings in one-half the width that the Canadian purchaser prefers. His reason is the more severe storm and wind conditions in that country which the material has to combat.

My friends amongst Canada's flour exporters tell me that the sacks in which their product is shipped are widely used as dress goods and underwear by native women in warm climates, and that when those Southern trade winds start blowing briskly he who looks may observe for himself the particular brand of flour which individual housewives may currently be using. There are other examples of a similar nature, such as the preference for brightly colored goods by the peoples of warm climates, or the fact that pictures of certain kinds of animals appearing on the label of a product, are offensive to peoples of other countries.

And so comes our third trading principle: Set your sales house in order now, as a safeguard against those new conditions, which as I have already pointed out, are even now peeping around the corner, when domestic demand must necessarily be far below your present capacity to produce.

Good Advice From Ottawa

Some years ago, as a young sales manager, I went to Ottawa and spent several weeks there at the Department of Trade & Commerce, learning some of the rudiments of the business of exporting. On my last day there the Deputy Minister of the Department, in bidding me good-bye, gave me this final piece of exporting advice. It might well be called an exporter's creed! He said: " Don't ever forget the 3 essential principles of exporting. First, always endeavour to write your export customer in his own language; second, when you quote him a price, do not quote it F.O.B. some inland manufacturing point in Canada, but always endeavour to quote him a price delivered at the nearest port of entry in his own country. Third, once you have established an export account, do not change anything, without notification, well in advance, of the change." By this he meant, do not change the appearance of the goods, or the packaging, or the labels, or the footage, or size, or weight of the packaged contents without due notification, and the exact reasons therefor.

These seem to be the days of slogans in business. Even our Federal Department of Trade & Commerce has adopted one in connection with its export endeavours. Their slogan is known by the letters " C Q P "— the letter " C " standing for Continuity of Supply of Canadian materials to the market places of the world. The symbol " Q " represents Quality that should be consistently good, while the letter " P " signifies Prices that are fair. Note particularly, please, that phrase " Continuity of Supply." A manufacturer can't turn a potential export business on and off like a faucet. The " In and Out " approach to an export business can lead only to dissatisfaction and final disaster.

Those of you who discern on the horizon the approach of those new conditions, which we may call opportunity, or business chance, or business change, or what you will—should pack your bags NOW in preparation for that interesting business venture into world markets. It may very well in the coming days mean to you and to your company or to your clients, the difference between the red figures of financial loss, and those darker hued digits which are so fascinating to bankers, owners, shareholders and investors alike. This statement is a challenge to those of us who are lulled into a false sense of economic security by their present seemingly imposing " back-log " of domestic orders.

The Cost of Strikes Expressed in Exports

Last year, untold damage was done to our national well-being by the widespread and persistent strikes in key industries, and extremely severe blows were thereby struck at our essential Canadian export volume. Contracts covering the export sale of Canadian-built vessels and railway cars were cancelled because of the suspension of production schedules by strikes, and consequent inability to make deliveries as promised. If the times comes in the future when our factories are closed down, or are put on curtailed schedules for lack of export orders, workers out of jobs will find little satisfaction in the belated realization that they, themselves, are largely to blame for their lack of employment. We must all strive mightily this year not to allow work stoppages of any kind to further hamstring our export potentials, whilst we bicker amongst ourselves about how to divide up a national income that we won't have unless we keep busy producing. During the first six months only of last year, industrial disputes in Canada were responsible for the loss of 1,626,000 man-working days. This means that products to the value of over $45 millions which could have been sold for export, would have been produced had no time been lost. This is a definite monetary set-back to each of us, through the loss of our individual share of Canada's export business.

Exporters Association of Value to Foreign Traders

There are bound to be problems in connection with Canada's foreign trading. These can best be grappled with by a group that specializes in such matters. The Canadian Exporters' Association, in which I am keenly interested, is in the front rank of important groups of businessmen in this country, and is carrying on a work that is of prime importance to Canada. It is a national organization, Dominion-wide in scope. It has since its formation four years ago been actively engaged in the furtherance of the success of Canadians interested in selling the products of this country abroad. It includes in its membership today 685 outstanding firms, in all branches of trade, engaged in the export of Canadian goods. Such a closely knit group places at a member's disposal the influence and the power of specialized organized effort. It can accomplish objectives that individual exporters, working alone, may not hope to attain.

By developing our Export Trade to the limit, each one of us can assist in promoting our own and our country's prosperity, and can aid in enhancing Canada's reputation and in building international goodwill. Canada's future prosperity is definitely tied up with the extent of her foreign business. Whatever that future may hold, however, Canada is not without great assets with which to meet it. There are few countries, if any, that have so many friends amongst the nations of the world, and none is more respected. Canada has always had the natural resources and today she has, in addition, the manufacturing facilities to raise the living standards of her people to new, high levels, as well as sharing out of her abundance with other nations throughout the world. Canada's 25,000 manufacturing firms, large, medium size and small, are today right in the forefront of the battle of production—all imbued, we trust, with energetic eagerness to measure up to, and to achieve, the high-

(Continued on page 477)

WATER CROSSINGS ON EXERCISE MUSK OX—SPRING 1946

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Extracts from a release prepared for *The Engineering Journal*

Lessons of value to engineers concerned with transportation problems in the far north during the spring breakup period are given in this article. Travel through muskeg country, and over small obstructions, including a corduroy road over rotting river ice, is described. Methods employed in building rafts at remote points for taking heavy vehicles across a large river are explained in detail, as well as the technique in ferrying them across in safety.

Exercise Musk Ox, in the dash south from Coppermine, became a race against time in order to beat the spring breakup. Mining men and old timers in the north country were skeptical that the party would ever get through that treacherous 260 miles between Fort Simpson and Fort Nelson. Lt. Col. Pat Baird, leader of Exercise Musk Ox, decided to send a party in advance of the main body to construct bridges and rafts wherever necessary. The writer had the honor of leading this party, being the only Naval man in the expedition, and because of the practical mining experience he had had with International Nickel.

On April 3, 1946, we left the convoy of ten snowmobiles at Dismal Lake and travelled 90 miles by aircraft to Port Radium. After obtaining a supply of small tools, and ½ inch cable we flew to the Norman Wells supply base, then on 300 miles to Fort Simpson, and thence down the winter tractor trail to Fort Nelson, in order to make an aerial survey of the trail, prior to the commencement of construction operations.

Advance Party Transported by Air

The main threat to the Exercise from breakup started at the Petitot River (76 miles north of Fort Nelson) and it was decided that a party of three picked men and myself would make a landing by glider on a small lake close to this river. Owing to rotting ice conditions it was impossible to land ski-equipped aircraft.

On the 14th of April the advance party, with all equipment, including a weasel (a small amphibious track vehicle) was safely landed on a small lake three miles from the Petitot River. Landing operations were carried out by joint Canadian-U.S. glider crews. A delay of 24 hours ensued since it was necessary first to clear the water saturated snow from the ice to make a runway so that the gliders could be snatched from the lake.

Corduroy Over the Petitot River

On the 17th of April our camp was set up in a tractor caboose left by the Canol Project. Wireless communication was established as a means of keeping informed concerning the movements of the main party. After checking the ice and depth of water of the Petitot River, we decided to build a corduroy road over the slushy snow and candling ice of the river, which at the point selected, was approximately 150 yards wide. The weasel took a beating during our water crossing operations. We used it not only as a bulldozer to knock over small trees, but also attached it to the free end of a block and tackle as a source of power in hauling out logs and on similar tasks. In this capacity it did the work of fifty men.

On the 22nd of April when work on the river crossing was completed, the moving force was reported to have left Fort Simpson. Water was beginning to flow over the ice of the river, and after the weakest section of the ice had been timber-dogged we estimated the crossing would be safe for at least five more days. Early next day our equipment was piled into the faithful weasel and we headed south. Much valuable time was wasted in clearing windfall from the trail since the bush on either side was too thick to circle around such obstacles. The Swede saw was found much more practical and time-saving than the cross-cut.

Building a Small Bridge

In seven hours we had travelled only 13 miles south of the Petitot River. At this point we were confronted by a small but deep stream which was about 50 feet wide. Two trees were quickly felled, trimmed, and placed into position with our block and tackle, using the weasel once again as the source of power. Notches were cut in these stringers at 18 in. intervals, and 8 in. dia. cross timbers 12 ft. in length were cut and placed in the notches, and held in position by drift pins. The bridge when completed, allowed 2 feet leeway on each side. The bridge was constructed in 13 hours including the felling, trimming and cutting of timber to size.

No time was lost in making and breaking camp and in eating. For sleeping we simply threw a tarpaulin on the bare ground under a spruce tree and crawled into our sleeping bags. Rations consisted of the American ten-in-one and the Canadian Monopack (Arctic) which were easily carried and protected from the weather, and took very little time to prepare.

On the 24th of April a Norseman Aircraft flew over our position. Some difficulty was experienced in locating us, and so a flare was sent up. After circling low the plane dropped the first mail we had received in ten days. Our advance was again delayed by windfall and when we halted for the night we had travelled only eight miles.

Fig. 1—Camp at Glider Lake, showing weasel used by party and lean-to shelter.

Through the Muskeg

We travelled in a drizzling rain next day and found ourselves getting further into muskeg country, a vast expanse of water with a few stunted bushes. The muskeg was still frozen solid under the water, which averaged about 2 feet in depth, and the going was better than in the bush. In the middle of this muskeg area we threw a track and almost overturned the vehicle. Fortunately it took only one hour of slopping about in the water to get the track back on the weasel. Since there were no timbers available it was necessary to use two large balloon tired wheels salvaged from a wrecked glider.

We were now 42 miles south of the Petitot River, our starting point. Our trail through the muskeg was marked by our discarded snowshoes and strips of cloth torn from a parachute and tied to the stunted bushes. At seven o'clock that evening a large beaver dam was bypassed. An attempt was made to establish wireless contact with Lt. Col. Baird but great difficulty was experienced in getting our transmission through. Our message finally had to be relayed via Yellowknife to Lt. Col. Baird and the moving force.

Fig. 2—Close-up of corduroy crossing, Petitot River. Planks taken from tent siding left by Canol project.

The last lap before reaching the Fort Nelson River turned out to be the most difficult of the entire trip, the trail being completely blocked by windfall for 200 yards at a stretch. The trail had to be literally cut through a solid mass of timbers piled into jumbled confusion like match sticks.

The Nelson River

On the morning of the 27th of April we arrived at the north bank of the river. The ice was just going out. Our first task was to sound the river to determine if there was any chance of fording it. We unloaded the weasel, and entered the vehicle in the water. The river proved to be ten to fourteen feet deep and could not be forded. Ice cakes carried by the five knot current presented too great a hazard to floating the snowmobiles across under their own power, since many of the snowmobiles had their seams opened by our winter's travel in the Arctic.

The only feasible method was to construct a raft strong enough to withstand the buffeting of the ice, operated on an endless pulley. The 2,000 ft. of half inch steel cable procured for just such an emergency,

Fig. 3—Bridge 13 mi. south of Petitot River.

was brought to the south bank by a bulldozer from Fort Nelson Air Base. Forty empty gasoline drums were successfully dropped by the RCAF on the sand of the river bank without one of the drums being made unusable.

Building Rafts

There were plenty of tall straight spruce trees available. Nine timbers, each 7 inches at the butt and 38 ft. long were cut. Rollers were then prepared and placed on the river bank, the 38 ft. stringers were moved into position, the outside timbers being set 20 ft. apart and the inner ones so placed that double banks of drums ran down each side and rested snugly between the timbers. A space approximately 9 ft. wide was left in the centre and extending the full length of the raft. This was to allow the snowmobiles to run on and off the raft without touching the drums. Cross timbers were placed on each end and between each drum. The corners were all tied in with drift pins and lashings while the remaining joints were lashed together with half inch rope.

Owing to the shortage of rope, each drum was secured to the stringers by a single turn around each end. In this way the weight of the snowmobiles, bearing on the cross timbers, would tend to make the raft more secure. The timbers were alternately placed in sequence, butt to tip, so as to evenly distribute the

Fig. 4—Loading snowmobile on raft. Note decking cross timbers and placement of drums.

weight and strain. The area running down the centre of the raft was decked over with saplings and secured with wire. As a result, the whole raft, when completed, was solidly constructed yet flexible enough to belly down in the middle with the weight, with bow and stern being about eight inches higher than the centre section. A towing eye of one inch nylon rope was attached to each end of the raft with a safety link so the strain of towing was distributed over the whole length, instead of on the end timbers.

The next task was to bring one end of the half inch steel cable from the south bank and attach it to the raft on the north bank. The river was over 400 yards wide, with a sand bar about 150 yards from the south bank. The weasel was sent across paying out a coil of one inch manilla rope as it went. The end was securely anchored on the sand bar while the weasel proceeded to the south bank and returned with the end of the half inch steel cable. The ends were then fastened together. The rope was run through a snatch block on the north bank, and the cable pulled across the river, and then attached to the towing eye in the bow of the raft, while the rope was attached to the stern.

Ferrying Vehicles Across

On the 28th of April the river was considered safe for ferry service, since only occasional blocks of ice were floating down. The raft was easily launched on the log rollers, the first snowmobile loaded, and the bulldozer on the south shore took up the strain on the cable. Enough strain was kept on the stern rope to keep the raft from drifting down-stream too far. When the first trip was successfully completed the empty raft was hauled back by a snowmobile pulling on the stern rope and the bulldozer on the south shore paying out the slack in the cable. This procedure was carried out in succession for each snowmobile.

Thirty men and one snowmobile still remained on the north bank. The thirty men were needed to keep a strain on the stern line as the last snowmobile was pulled across. Finally the tenth and last snowmobile was embarked and landed safely on the sand bar. Then began the laborious task of hauling the raft back to the north shore by hand. Finally the raft grounded to a halt on the north shore, the thirty men piled aboard, and took up their positions on the raft. Since it was now completely dark the signal to start hauling was given by a flashlight. Slowly we swung out into the stream. A red flare was lighted on the sand bar and with this as a guide to judge the distance, we swung downstream like a giant pendulum with the river current, and rounded the tip of the sandbar into the back-eddy behind the bar.

The expedition spent that night on the sand bar. The remaining 150 yards to the south shore was accomplished in short order on the following morning. From the Fort Nelson River to Fort Nelson no other water crossings were encountered. Then we struck the Alcan Highway . . . the rest is history.

It is my opinion that some of the lessons learned on the Musk Ox Expedition will be of great value to mining men and the whole of Canada in the near future when we start to roll back our last frontier above the Arctic Circle.

THE CANADIAN WELDING BUREAU

(Continued from page 461)

engineer or Company all the pertinent data covering the world's experience with a particular welding problem or application in less than a week's time.

A Welding Symposium

These education and research activities are some of the projects to which the Canadian Welding Bureau would willingly lend a hand. Another would be a welding symposium. With papers and participants from across this Dominion and this Continent as well as from Great Britain and Europe such a symposium could not fail to achieve success. It would render a valuable contribution to welding knowledge in Canada. It is a project indeed in which the Bureau would welcome the leadership and the honour of association with The Engineering Institute of Canada.

EXPORT TRADING—CANADA'S HIGHWAY TO PROSPERITY

(Continued from page 474)

est possible levels of production and distribution, both at home and abroad. Of these 25,000 manufacturers, only 3,629 of them, or 15 per cent are today actually doing export trading.

Almost Any Manufacturer Can Be An Exporter

I trust what I have said may be thought-provoking and that you will deem it worthy of serious consideration. In closing, I should like to suggest that you do not look upon export trading as some vague and nebulous business adventure and that you do not consider a far distant foreign market as some remote and far-away happy hunting-ground. Instead, you should regard the business of foreign trading as the natural heritage of every Canadian. You should consider that foreign markets are well within your normal sphere of ordinary business trading. Stripped of any particular trading hazards, export trading is only domestic trading extended! Just as you have always allocated tonnage to your domestic trading areas, you should plan to set aside tonnage earmarked for trade in foreign fields, which business will be more important to you in the days and months that lie ahead.

Let us not be frightened by the problems which may confront us in doing export business. Let us rather be thankful that we are more than a match for them. Let us resolve to be a part of the solution of the problem rather than a part of the problem itself. The war has brought new appreciations everywhere of Canada's position in world affairs, in finance, in politics, and in trade. If we all continue to play our full part, both in our home market and in those lands where favorable trade winds may blow, we shall soon find ourselves in the happy position of being able to make Canada the most enviable country on this earth, in which and from which to conduct our business affairs.

RECENT TESTS IN INDUCTIVE CO-ORDINATION OF RURAL ELECTRIFICATION AND TELEPHONE LINES

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A paper presented before the Peterborough Branch of The Engineering Institute of Canada on March 22nd, 1947

Four exposures to induction are dealt with, three of them in Alberta and one in Quebec. Types of induction are defined, and the "Telephone Influence Factor" (TIF) is explained. Test conditions, sources of noise, volume of noise, TIF, etc., are discussed for each of the four exposures. The effect of separation is appraised.

This report deals with three exposures in Alberta and one in Quebec, all at 60 cycles. These four cases are known as: The Olds Experimental Area, (Fig. 1); The Rockyford Exposure, (Fig. 2); The Brooks Exposure, (Fig. 2); and The St. Gertrude Exposure, (Fig. 3).

These four cases are all quite different, but there are so many variables associated with exposures between power and telephone lines, that they do not by any means serve to represent all types of exposures arising from rural electrification. However, when constructions of a similar nature are under consideration, a study of these four cases may assist in estimating what can or cannot be done without becoming involved in remedial measures.

TYPES OF INDUCTION

Induction from power lines may be classified as: normal, or steady state; or abnormal, or transient. The normal induction is rarely severe enough to do any damage to the telephone system, and even when it is severe, damage is easily prevented by simple drainage devices. The chief effect of normal induction therefore is to produce noise in the telephone lines.

The transient induction, due to faults and switching surges, may be severe enough to cause acoustic shock, or to take the telephone lines out of service by burning the lightning-arrester blocks together. In the case of rural electrification, however, the fault currents are usually quite small, and the resulting transient induction has not been serious. This report will accordingly be confined to the normal or steady-state induction.

The noise caused by induction from the power lines is due almost entirely to the harmonics of the power frequency. The telephone receiver and the human ear are both quite insensitive to 60 cycles, and if the graphs of voltage and current in our power lines could be pure sine curves there would be no noise problem. Unfortunately nearly all types of power apparatus produce harmonics, and although these harmonics are partly subject to the control of the designer, they can not be eliminated completely.

THE NOISE METER

The Western Electric 2B noise meter consists of a selective network, potentiometer, rectifier, and direct-current milliammeter. The network is connected across the telephone line, and is so designed that the current per impressed volt at each frequency is directly proportional to the noise-producing ability of that frequency. For example, one volt at 1000 cycles produces about 2000 times as much current through the noise meter as is produced by one volt at 60 cycles.

The scale of the noise meter reads in decibels (db) above the arbitrary reference level of 10^{-12} watts of 1000-cycle power input to the noise meter. In order to give some idea of the relative meaning of db. noise readings in terms of interference with speech, it may be stated that as long as the noise on a telephone line does not exceed 29 db. the line may be considered first class, and no remedial measures are necessary. On the other hand a line noise of 69 db. makes conversation practically impossible.

TELEPHONE INFLUENCE FACTOR (TIF)

The telephone influence factor, or TIF, of a power-line voltage or current wave is a measure of the harmonic content of that wave, each harmonic being weighted according to its ability to induce noise in a paralleling telephone line. It is usually measured by means of a noise meter and a coupling network known as a TIF coupler.

The TIF scale is purely arbitrary. The power-line frequency that is most effective in producing noise in a paralleling telephone line is 1080 cycles, and this frequency has arbitrarily been assigned a TIF of 12,000. Tables of TIF values generally show the TIF of a 60-cycle pure sine wave to be 1, which is not at all precise but is accurate enough for the purpose. It is much more important to know what values of TIF can reasonably be expected on a 60-cycle power line. In general the voltage TIF of 60-cycle lines ranges from about 10 to 80, although values up to 300 have been measured in the vicinity of large mercury-arc rectifier installations, before applying remedial measures.

Doubling the TIF of a power-line voltage or current increases the noise induced in a paralleling telephone line, by that voltage or current, by 6 db.

NATURE OF THE TESTS

The principal quantities measured in these tests were:

(1) Noise-metallic* and noise-to-ground* on the telephone lines, by means of a noise meter.

(2) Voltage TIF of the power line, by means of a noise meter and a TIF coupler.

(3) Ground-return IT product* on the power line, by means of a noise meter and a 100-ft. probe wire lying on the ground. (Fig. 8)

(4) The load on the power line.

(5) The resistivity of the earth, by means of an earth tester.

The power-line conditions were varied as much as was feasible in each case in order to determine the relative importance of the various sources of noise.

The Olds Experimental Area. (Fig. 1)

DESCRIPTION

In this type of rural electrification the distribution is entirely single phase, at 6.9 kv., with one conductor multi-grounded. Each substation consists of one single-phase transformer, feeding an area not

* These terms are defined in the appendix.

over 20 mi. square, and placed near the center of that area. In general, four single-phase 6.9 kv. lines radiate from this substation. Fig. 1 shows the line east from the substation at Olds. This line is 11.4 mi. long, and throughout its entire length parallels a telephone lead at a roadway separation of 60 ft. The branches on this line amount to 25.6 mi. making a total line mileage of 37 mi. There are 61 distribution transformers, each rated 3 kva., connected to this line, making a total connected transformer capacity of 183 kva. The other radial lines from the substation are only partially developed, and carry a total connected transformer capacity of only 147 kva., making a grand total of 230 kva. connected to the 50 kva. substation.

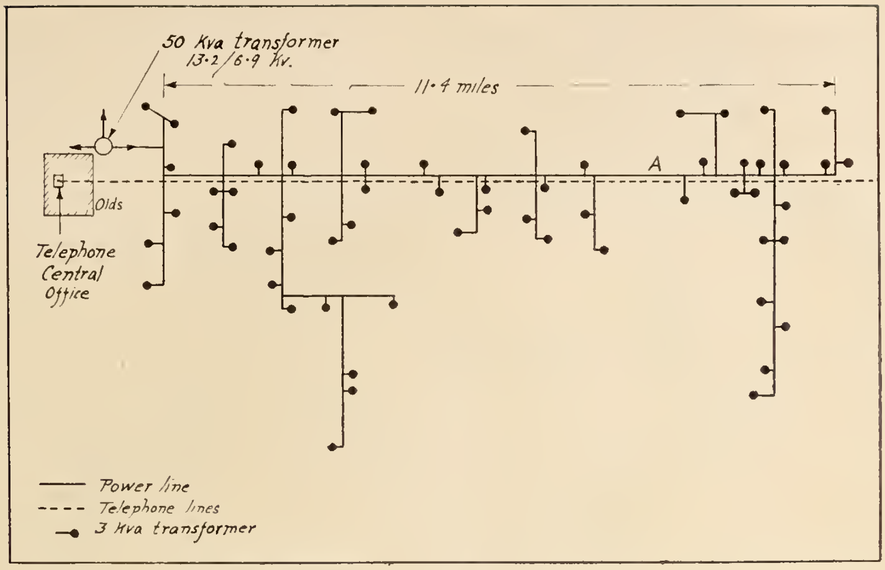

Fig. 1.—Rural electrification. Olds Experimental Area, Alberta. 6.9 kv., single-phase. 1945.

TEST CONDITIONS

1. Power line dead.
2. All branches and distribution transformers disconnected from the line. (It was not considered feasible to disconnect each transformer primary separately, so as to retain the branches.)
3. All transformer primaries connected on the main stem, but secondaries open. Branches disconnected.
4. Normal operation.

The noise was measured in Olds Central office, on a toll line that was terminated at Trochu, 37 miles east of Olds. Check readings were taken on three rurals on the same pole line.

SOURCES OF NOISE

In all tests the ground-return IT product was sufficient to account for practically all the noise measured. The electric induction from the 100 per cent residual voltage undoubtedly produced noise, but its contribution was not measurable in the presence of the major noise source.

The ground-return current is made up of 3 components—(1) The residual line-charging current; (2) The residual transformer exciting current; and (3) The residual load current. Apparently the ground-return component of the line-charging current was the major source of noise in the Olds exposure. At any rate the noise measured under normal operating conditions was actually less than the noise expected from the line-charging currents only, the calculation being based on test No. 2, and on the assumption that the line-charging IT would be proportional to the mileage of line energized. When measuring line-charging current there is of course always the danger of obtaining quarter-wave resonance for one of the harmonics, since the line is open all the way.

NOISE

Under normal operation the noise-metallic was 15 db., and the noise-to-ground 30 db. This noise was all created by the line east from Olds. If the toll line passed through the area it would also be exposed to the line west from Olds, but this should not increase the noise, because the ground-return currents flow in opposite directions in the two exposures. There might even be a reduction in noise.

A toll line may pass through several such areas in succession. Adjoining areas are fed from different phases, and the distance between areas fed by the same phase is large. Therefore root-sum-square addition of noise should be employed. Thus if one exposure produces 30 db. noise-to-ground, two exposures should produce 33 db., three exposures 34.7 db., etc., up to 10 exposures to produce 39.8 db. The corresponding noise-metallic should not exceed 29 db. Therefore it would appear that a toll line might pass through 10 such areas in succession without picking up an excessive amount of noise.

It is important to note that the voltage TIF in this area was only 11. Doubling the TIF would increase the noise by 6 db. Consequently if the TIF had been 44 the noise-to-ground from the single exposure would have been 42 db., and the noise metallic 27 db. The success of this type of rural electrification is therefore contingent upon the voltage TIF being maintained at a reasonably good value.

EFFECT OF A BREAK IN THE MULTI-GROUNDED NEUTRAL

The neutral conductor was cut at point A, (Fig. 1) three miles from the far end, thus forcing all the current from the last 20 transformers into the ground, as well as the line-charging current of some 22 miles of line. This did not cause any measurable increase in the ground-return IT measured at the input end of the exposure. Therefore all the current that was forced into the ground by the cutting of the neutral at point A must have re-entered the neutral conductor through its various grounds before arriving at the input end of the exposure. There must have been some increase in the noise but it was so small that it was masked by the fluctuations and could not be measured. The purpose of the test was to show that the omission of a section of a neutral conductor has only a local effect, if the neutral is multi-grounded.

It has been argued that since the earth resistivity is unusually low in this area, namely about 10 ohms per meter cube, most of the current would be returning through the ground in any case. Cutting the neutral would therefore have little effect, but quite different results might be obtained in an area of high earth resistivity. This argument is sound as regards the 60-cycle component, but the 60-cycle component contributes almost nothing to the IT product. The distri-

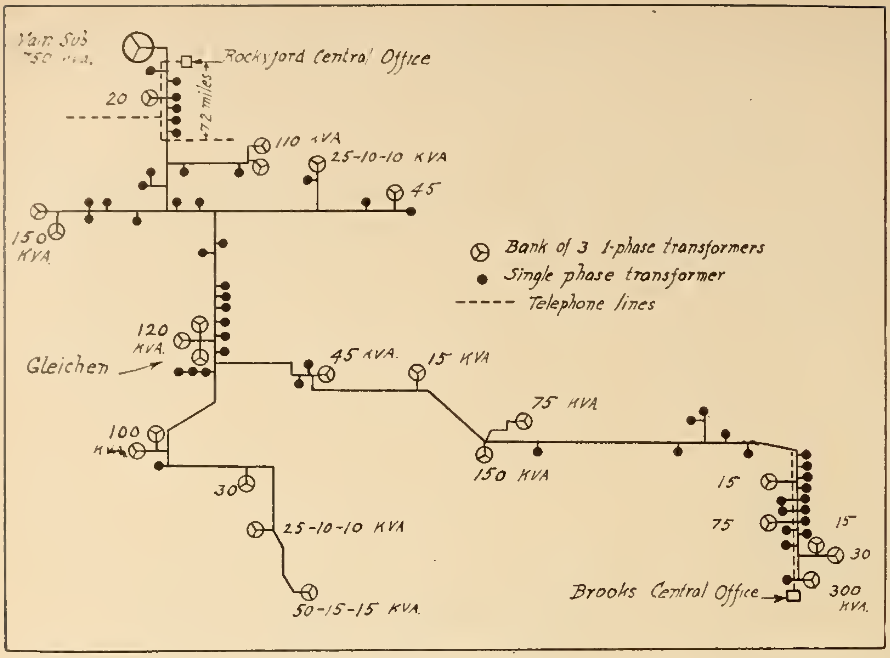

Fig. 2.—Power and rural electrification combined. The Rockyford and Brooks Exposures, Alberta. 22-kv., 3-phase star, 3-conductor. All transformers are 13 kv. The ground is the neutral. 1945.

bution of the harmonic currents that are mainly responsible for the IT product is determined almost entirely by the reactances of the various return paths. A large proportion of these harmonic currents therefore returns through the neutral, regardless of the earth resistivity.

The Rockyford Exposure. (Fig. 2.)

DESCRIPTION

The power line is 22 kv., 3-conductor, 3-phase star throughout. All transformer primaries are star connected and the ground serves as the neutral. Single-phase taps into farms are therefore single conductor. The total line mileage fed through the exposure is 165 miles, and the total connected transformer capacity fed through the exposure is 1,785 kva., of which 1,340 kva. is in three-phase banks. The substation that feeds this system consists of three 250 kva. single-phase transformers, connected delta-star.

The line was originally 13 kv., 3-phase delta, but was converted on Sept. 2, 1945. The power line is transposed every mile, except for a length of 25 miles, east of Gleichen, which is not transposed at all. The exposure is just south of Rockyford and consists of 7.2 mi. at a roadway separation of 65 ft.

TEST CONDITIONS

1. Before conversion.
2. Power line dead.
3. All transformers disconnected from the line except one 7.5 kva. 3-phase bank near Brooks, and a 30 kva. 3-phase bank at Queenstown. Line energized at 22 kv. star.
4. Changeover to star complete. Light load.
5. Changeover to star complete. Heavy load.

The noise was measured at the Rockyford central office on two toll lines and one rural, all terminated at the far end of the exposure.

SOURCES OF NOISE

In all tests the noise was due entirely to induction from the ground-return current. Test No. 3 gave a reading of 90 for the ground-return IT of the residual line-charging current. Test No. 4 gave a reading of only 61 for the ground-return IT of the residual line-charging current and transformer exciting current combined. Test No. 5 gave a reading of 120 for the ground-return IT of all three components of residual current combined. The difference between the IT readings of tests 3 and 4 strongly suggests that some resonant condition resulted in too high a reading for test No. 3.

Since the components of the ground-return IT probably add approximately according to root-sum-square addition, it follows that the load-current component of the ground-return IT was approximately 1.7 times as large as the combination of the other two components. *Hence the major source of the noise is the load-current component of the ground-return current.*

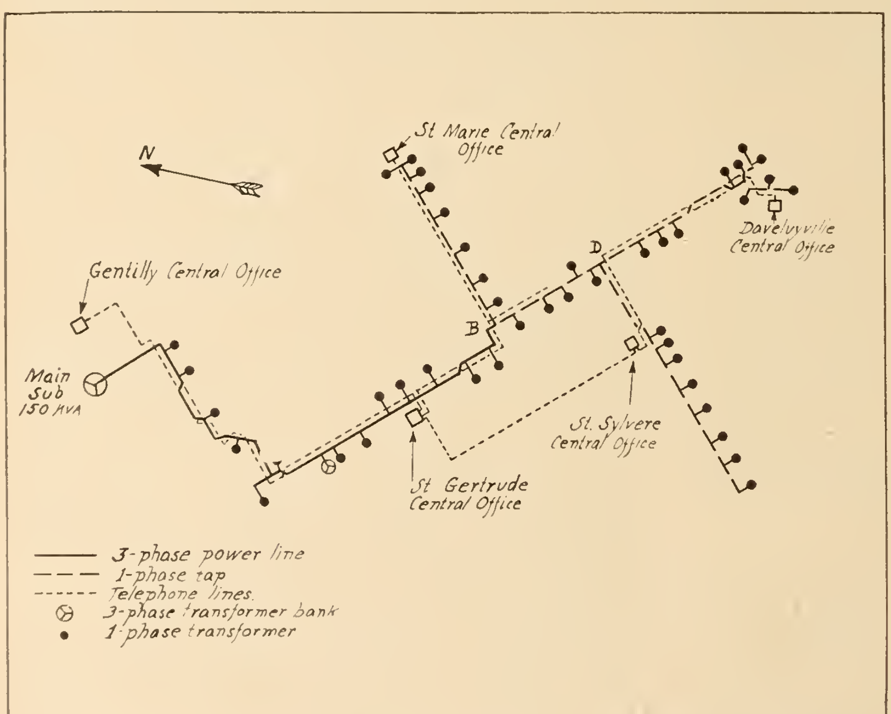

Fig. 3.—Rural electrification. The St. Gertrude Exposure, Quebec. 12 kv., 3-phase star, 4-conductor. Multigrounded neutral. All transformers are 6.9 kv. 1945.

NOISE

Converting from 13 kv. delta to 22 kv. star increased the noise-metallic from 13.5 db. to 15.5 db. The load was 650 kva. when the 15.5 db. reading was taken, and this is near the substation rating of 750 kva. The corresponding noise-to-ground was 28 db.

The load could certainly be increased to at least three times its present value without causing any trouble, and probably a much larger increase could be permitted because in general it is not expected that the residual current will be proportional to the load current.

The voltage TIF at maximum load was only 8.4. In an exposure in which a large portion of the load consists of three-phase induction motors, and in which the noise is due to the ground-return component of the load current, the author is not prepared to predict what the noise would have been if the voltage TIF had been, say, four times as large. It seems safe to say however that increasing the TIF to 33.6 would not have raised the noise by more than 12 db., which would still leave it within the allowable limit. The earth resistivity was about 10 ohms per meter cube.

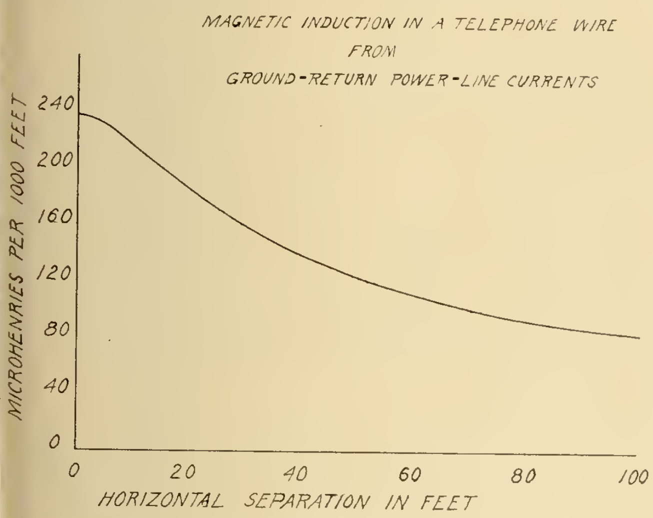

Fig. 4.—Variation of induction with horizontal separation.

THE BROOKS EXPOSURE. (FIG. 2.)

This is a 12 mile exposure at a roadway separation of 60 ft. The power line has already been described in the description of the Rockyford exposure. With a load of 215 kva. fed into this exposure the noise-metallic was 20 db., and the noise-to-ground 31 db. The load-current component of the residual current was the major source of the noise, as in the Rockyford exposure. Trebling this component of residual current would still leave the noise-metallic below 29 db.

Converting from 13 kv. delta to 22 kv. star increased the noise by something between 3 db. and 9.5 db. The uncertainty is due to the fact that the load was not measured in the before-conversion tests. The earth resistivity in this case was about 10 ohms per meter cube.

THE ST. GERTRUDE EXPOSURE. (FIG. 3)

DESCRIPTION

Before conversion the line was 6.9 kv. 3-phase delta from the main substation near Gentilly to point B. The rest of the system consisted of two single-phase taps, one 8.6 mi. long and the other 14.6 mi. long. After conversion the line was 12 kv., 3-phase star, four-conductor, from the substation to point B, with the neutral multi-grounded. The rest of the system was single-phase 6.9 kv., with one conductor grounded. The connected transformer capacity consisted of 152 kva. of small single-phase transformers, mostly 3 kva., and one 5 kva. 3-phase bank.

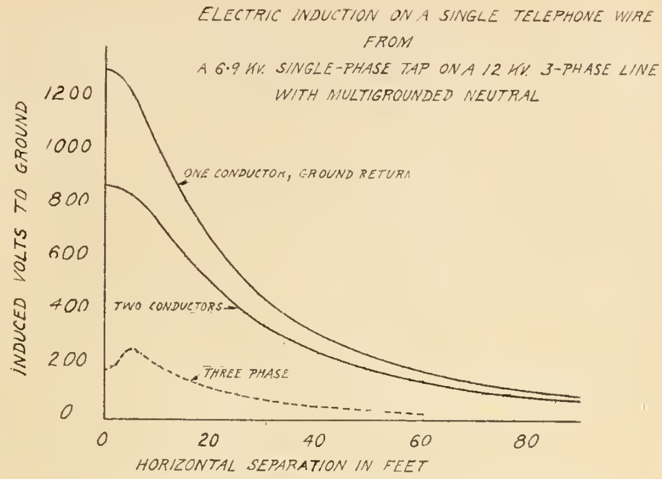

Fig. 5.—Variation of induction with horizontal separation.

A trunk telephone line parallels the 3-phase portion of the line, at a roadway separation of 28 ft., from near Gentilly to St. Gertrude, a distance of 8.4 mi. It then follows a separate route to St. Sylvere, after which it is exposed to a single-phase tap at 26 ft. separation all the way to Daveluyville, a distance of 6.8 mi.

The noise measurements were all made in the St. Gertrude central office. In the section between St. Gertrude and Gentilly the noise measurements were made on the trunk line and on the longest rural, which was 3.6 mi. long. In the section on the other side of St .Gertrude the noise measurements were again made on the trunk circuit and on the longest rural, which was 4.1 mi. long, and which parallels the line at roadway separation all the way.

TEST CONDITIONS

1. Normal operation before conversion from 6.9 kv. delta to 12 kv. star.
2. System dead.
3. Line converted to star but only the three-phase portion energized.

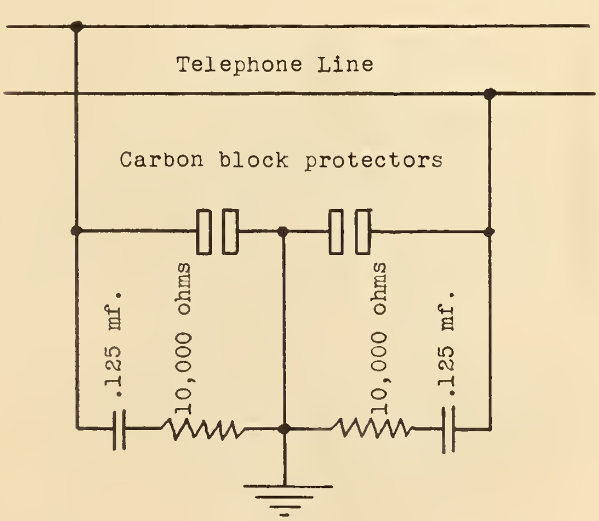

Fig. 6.—Drainage unit for telephone lines.

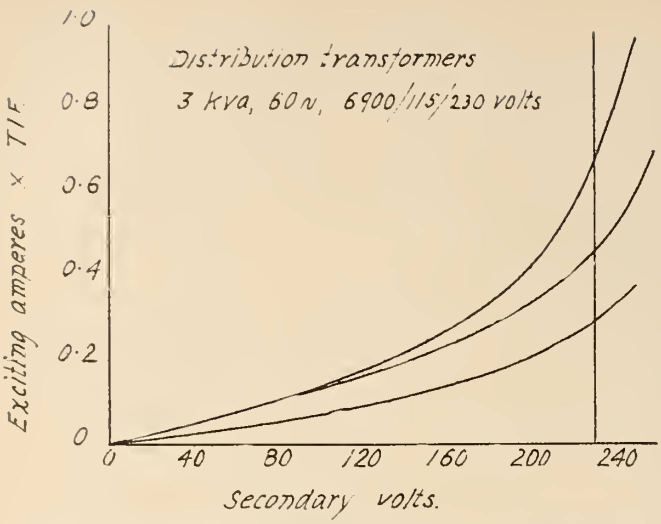

Fig. 7.—Variation of exciting IT product with voltage for 3-kva. transformers from 3 well known manufacturers.

4. Daveluyville single-phase tap added, but the St. Marie and St. Sylvere taps dead.
5. Complete system energized.

INCREASE IN NOISE RESULTING FROM CONVERSION

The noise readings were somewhat erratic, owing to the poor condition of the telephone line. Averaging all readings taken before conversion, and all the readings taken after conversion, we find that the average noise-metallic was 34 db. before conversion and 45 db. after conversion, an increase of 11 db. The average noise-to-ground was 27 db. before conversion and 41 db. after conversion, an increase of 14 db. Note that the noise-metallic was actually larger than the noise-to-ground, whereas in every case in the Alberta tests the noise-metallic was at least 10 db. less than the noise-to-ground. If the St. Gertrude telephone lines had been in as good condition the average noise-metallic after conversion would have been 31 db., which would have been quite satisfactory.

SOURCES OF NOISE

In the section between St. Gertrude and Gentilly, which is all three-phase, the noise was due entirely to the induction from the ground-return current. No attempt was made to separate the three components of this current. In the single-phase section between point B and Daveluyville the noise appears to be due chiefly to electric induction from the 100 per cent residual voltage.

The voltage TIF was 36.6 before conversion. After conversion, but with only the three-phase portion energized, it was 47.5. Adding the single-phase taps raised it to 81. The reason for this large increase has not been investigated, but it was certainly an important factor in the increasing of the noise. In fact if this TIF could be cut in quarter it would probably be possible to carry on without any other remedial measures.

Since it was not possible to cut the TIF in quarter, and since it would have been too expensive to rebuild the telephone system, the power line was converted back to delta.

Effect of Separation on the Induction

In the Alberta exposures the separation is usually about 60 ft., while in Quebec it is often less than 30 ft. In the United States there are cases of joint use in rural electrification, in which the horizontal separation is zero feet. Figures 4 and 5 show the variation of induction with horizontal separation. From Fig 4 it may be seen that the magnetic coupling for ground-return power currents doubles when the horizontal separation is decreased from 55 ft. to zero feet. The corresponding increase in noise is only 6 db. In the case of electric induction however, as shown in Fig. 5, the variation with distance is much greater, and at 30 ft. separation, or less, electric induction from single-phase taps with one conductor grounded can cause telephone protectors to break down, if the telephone line is exposed throughout its entire length. In that case drainage is required. Figure 6 shows a type of drainage developed for joint use. The condensers are not required unless it is desired to apply D.C. tests to the line. The carbon blocks protect the resistors from lightning damage. In the case of joint use these drainage units are spaced along the telephone line at from 2.5 to 5.0 mile intervals.

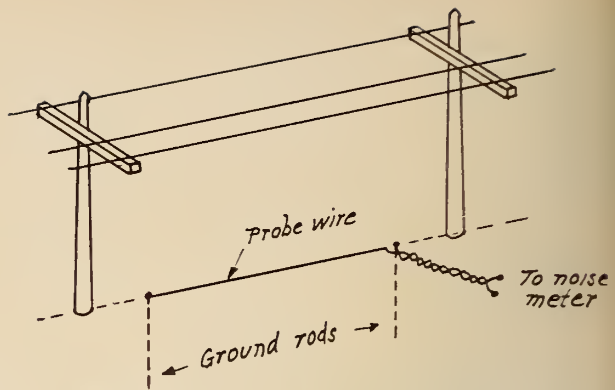

Fig. 8.—Measurement of ground return IT product by means of probe-wire.

Exciting Currents of Distribution Transformers

Transformer exciting currents are rich in harmonics, especially if the iron is operated high on the saturation curve. Figure 7 shows how rapidly the exciting IT product increases with voltage. Since the successful co-ordination of rural electrification systems with multigrounded neutrals is largely dependent on the maintaining of a good TIF, power companies are well advised to give due consideration to the exciting IT product when buying transformers.

Appendix

NOISE-METALLIC

The noise-metallic measured at any point is the noise that a telephone subscriber would hear if he were located at that point. It is measured by bridging the noise meter across the line. It is as much a function of the equality of the line, and of its co-ordination, as it is of the severity of the exposure, and therefore cannot be used as the measure of the severity of the exposure.

NOISE-TO-GROUND

The noise-to-ground is the noise measured by connecting one terminal of the noise meter to ground, and the other terminal through 100,000 ohms to the two telephone wires in parallel. When both electric and magnetic induction are present in important amounts the telephone line should be terminated to ground in its own characteristic impedance to ground, at both ends of the section under test. When only one type of induction is important simpler terminations may be

(*Continued on page 498*)

ROLLS-ROYCE "EAGLE" ENGINE

Design Details of Britain's Most Powerful Piston Engine

The new Rolls-Royce "Eagle" engine is a 24 cylinder, liquid cooled, flat "H" type engine, incorporating a two-speed, two-stage, centrifugal supercharger and gearing for contra-rotating propellors. The increase in the number of cylinders is a logical development from the "Griffon" engine, which had reached what is generally considered to be the limit of cylinder bore. Production engines are delivering 3,500 hp. and the "Eagle" is not only the most powerful piston type engine in production in the world, but is also the most powerful piston engine to have flown. In connection with development it is interesting to note that the total piston area of the "Eagle" is twice that of the "Merlin" and it would not be unreasonable to suppose that as experimental work progresses it will deliver twice the horse-power of the best "Merlin" engine.

Design Considerations

With the object of producing a reliable, large capacity, sleeve valve engine, capable of withstanding the high b.m.e.p., made possible by liquid-cooling and efficient supercharging, constructional rigidity has been made a feature of the "Eagle" design. The crankcase is in two halves, and of extremely robust construction with individual panels, reinforced by ribbing, for the seven main bearings of each of the two crankshafts. Cylinders are cast in two blocks of twelve to assist rigidity, and the blocks and crankcase halves are held in compression by 24 high tensile steel tie rods, which pass through the engine and are nutted on the external faces of the cylinders.

The crankshafts are of the four mass-balance type, with a torsional damper fitted on the rear balance weight of each shaft to smooth out any vibrations which may occur. They rotate oppositely and are arranged in conjunction with paired cylinder firing to provide balancing of all major forces. Paired cylinder firing also reduces the torsional vibration the airscrew has to withstand.

To avoid excessive width of engine and permit simplified induction and exhaust systems and convenient location of the spark plugs, single sleeve valves are used on the "Eagle" in place of poppet valves, as on the "Merlin" and "Griffon". These are of orthodox construction with three inlet and two exhaust ports.

A wide range of performance at both moderate and high altitudes is provided by the two-speed, two-stage centrifugal inter-cooled and after-cooled, supercharger. Although of considerable capacity, to cope with the enormous air consumption of the engine, the supercharger and coolers have been kept down in dimensions and the after-coolers do not overflow beyond the width of the cylinder blocks.

The reduction gear casing has an extension at the forward end to house the thrust bearing of the airscrew shaft, the shaft being lengthened to bring the contra-rotating propellers well forward of the main bulk of the engine. By this means an unbroken cowling line is obtained with the major portion of the engine well inside the fuselage.

Special attention has been paid to the design of the cooling system and what is technically known as "shunt" cooling is employed. With this system, pressure loss on the inlet side of the coolant pump which would upset the mass circulation, is eliminated. The system is in effect a closed circuit, the coolant flowing from the pump through the cylinder blocks to swirl type outlets at the top of the blocks and then to the radiator and back again to the pump. The "swirl" outlets separate the vapour from the coolant and pass it to a header tank mounted on the top of the engine. The header tank acts as a reservoir for coolant and is connected to a venturi at the pump inlet. Should any decrease in pressure occur at the pump due to cavitation it is immediately restored by a flow of coolant from the header tank to the venturi.

Design Details

Lubrication follows current "Merlin" and "Griffon" practice with the main bearings and big ends, lubricated from the hollow interior of the crankshafts. This method of lubrication whereby the oil is supplied at each end of the crankshaft, ensures a positive oil feed to the big end bearings as well as the main bearings, and gives greater bearing area without increase in journal width or diameter.

Sleeve Valve Drive

The sleeve valve drive comprises a longitudinal drive shaft fitted on each cylinder block and providing a drive for the sleeves in the upper and lower banks of cylinders. The shaft has integral worm gears which engage with worm wheels mounted on six pedestal bearings. The shafts are driven by spur gearing from the rear end of the upper crankshaft; they are also hollow to convey main pressure oil to the worm gear bearings. Although this is the first time Rolls-Royce have used sleeve valves on a production engine — a 24 cylinder sleeve valve 'X' shaped engine has previously been built. This engine proved very satisfactory and considerable test bed and flight development had been done—when the intervention of the war and full concentration on the "Merlin" and "Griffon" stopped further development.

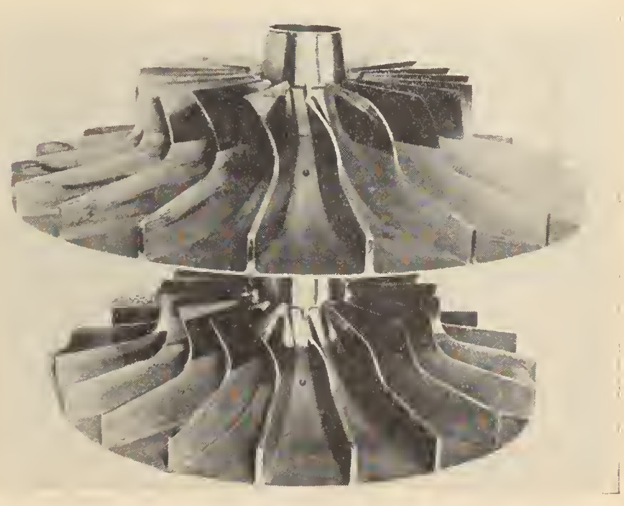

Fig. 1—Impeller of the Eagle's 2-stage supercharger.

Over 1,000 hp. Transmitted to Supercharger

The two-speed, two-stage supercharger is driven by a spring drive from the rear end of the upper crankshaft, through hydraulically operated centrifugal clutches. After-coolers, which are entirely separate from the main coolant system are placed between the four supercharger outlets and the induction pipes, to cool the mixture after compression. Intercooling of the " mixture " is also provided by vane annular passages in the supercharger casing between the first and second stage impellers. The air-intake is updraught with the discharge nozzle of the fuel system injecting petrol directly into the airstream at the supercharger eye.

Over 1,000 hp. is transmitted by the clutches and supercharger drive, so considerable design work had to be done to provide gears and clutches of sufficient capacity and of reasonable size to transmit this power.

A two layshaft scheme has been adopted, the layshafts being mounted either side of idler gears through which the drive to the impellers is transmitted. Each layshaft carries two small clutches for the respective supercharger ratios, the double-clutches and gears thus reducing the torque load and enabling low capacity gears and clutches to be used.

Engagement of the friction clutches for the two ratios of supercharge is by centrifugal weights placed between the clutches. The change in ratio is effected by a hydraulic ram housed in the wheelcase and linked by a forked rod to a sliding cylinder in each supercharger drive layshaft. The supply of oil to the ram is controlled by a piston valve actuated by a solenoid. The change in ratio can be made by either manual operation of an electrical switch or automatically by an aneroid which closes the electrical circuit at the correct altitude.

Fuel System

The successful development of fuel injection on the smaller Rolls-Royce engines had been applied to the " Eagle " and an injection pump, manufactured by the S. U. Carburettor Co., supplies fuel under pressure to the supercharger eye. The pump unit is small and light and contains a five-plunger pump operated by a swash-plate. The stroke and capacity of the pump are varied by alteration in the angle of the swash-plate which assumes a mean position after compensating for all the variables determining fuel demand. As the pump is of the positive displacement type, elimination of air from the system is covered by a de-aerator interposed between the delivery side of the pumps in the aircraft tanks and the suction side of the fuel pump.

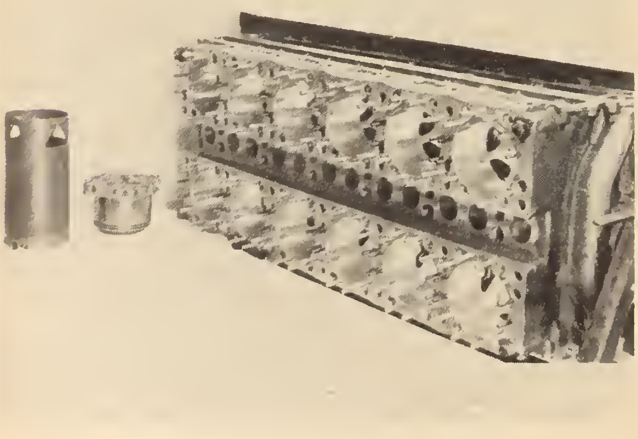

Fig. 2—One of the cylinder blocks, with a sleeve and cylinder head.

Engine Controls

A large, semi-circular plate-type throttle is used in the air intake giving an entirely unrestricted air flow into the supercharger. Special attention has been given to the design of the throttle and it is arranged to have an opening tendency on acceleration, due to an out of balance weight, and a closing tendency on deceleration.

On account of its shape, the throttle is also free of all aerodynamic loads, as these act normal to the surface and are therefore dissipated as bearing loads. The throttle is gear driven from the boost control and the ratio of throttle movement to pilot's lever movement is 1:1 over the whole range to ensure maximum sensitivity to pilot's control. A variable datum boost control, interconnected with the supercharger throttle valve is provided to maintain automatically the boost pressure determined by the position of the throttle control lever. The arrangement is generally similar to previous Rolls-Royce boost control units, except that the throttle is actuated by epicyclic gearing and that external control rods have been kept to an absolute minimum.

Performance

Details of the performance of the " Eagle " may not be disclosed as yet, but indications of what may be expected can be gleaned from the engine performance figures.

At combat rating, in the moderate ratio of the supercharger, the power output of the engine at sea-level is 3,420 hp. reaching a maximum of 3,500 hp. at 2,750 ft., the full throttle condition. In the full supercharger gear, the 3,000 plus hp. figure is maintained to over 14,000 ft., reaching a maximum of 3,150 hp. at the full throttle height.

Similar examples can be quoted for climbing and cruising conditions with lower power figures on account of the reduced boost, but still in the 2/3000 hp. range up to 22,000 ft.

Other interesting figures are the power ratio in relation to frontal area and the high b.m.e.p. achieved. As the frontal area, taking in all engine fittings, is only 10.6 sq. ft., the ratio of power to frontal area is 328.5 hp. per sq. ft., which is only 10 hp. less than the much smaller Merlin engine and shows how well the designers have done their job in keeping such a large engine so compact. The b.m.e.p.. figure is higher than any previously published figure for a sleeve valve engine, and is an indication of what can be done by efficient supercharging and liquid cooling.

Performance Data

Rated height—9500 ft. M.S. 19,500 ft. F.S. at 12 lbs. sq. in. boost. 3,300 R.P.M.
Max. b.h.p.—3500 at 2750 ft. F.T.
Max. r.p.m.—3500.
Cruise r.p.m.—3100.
Max. b.m.e.p.—282 lbs. per sq. in.
Power per Litre.—76 B.H.P.
Power per sq. in piston area—6,375 B.H.P.
Power per sq. in frontal area—328.5 B.H.P.
Max. consumption—350 gal. per hr. at 14250 ft. F.S. Combat.
Take-off consumption—342 gal. per hr. at S.L.
Climb consumption—176 gal. per hr. at S.L.M.S.
Max. cruise consumption—142 gal. per hr. at S.L.M.S.

From Month to Month

News of the Institute and other Societies, Comments and Correspondence, Elections and Transfers

ILLNESS OF GENERAL SECRETARY

Members in many parts of Canada will learn with regret that the general secretary has been confined to home and hospital since August 25th. At the time of writing he is still in hospital and the doctor's statement is that he will be there for several weeks yet, after which it may require some months of further attention before he is back to normal.

Only those who know Dr. Wright personally can appreciate how completely his time and energies have been devoted to the Institute during the past ten years. It was inevitable that the reaction, when it finally came, should have been quite serious and that a considerable period will be required for his recovery. At this writing there is every indication that the recovery will be complete but may require him to take things easily for a few months.

IMPORTANT MEETING TO BE HELD IN MONTREAL

On October 24th and 25th the Institute will be host at the Mount Royal Hotel in Montreal to a group of particularly eminent American and Canadian Engineers and educators. The occasion will be the 15th Annual Meeting of the Engineers' Council for Professional Development of which The Engineering Institute of Canada is, at the moment, the only member organization outside the United States.

The E.C.P.D. is a North American Conference of engineering bodies organized to enhance the professional status of the engineer through the cooperative efforts of the following organizations:

American Society of Civil Engineers
American Institute of Mining and Metallurgical Engineers
The American Society of Mechanical Engineers
American Institute of Electrical Engineers
The Engineering Institute of Canada
American Society for Engineering Education
American Institute of Chemical Engineers
National Council of State Boards of Engineering Examiners.

The objectives of the E.C.P.D. are stated in its Constitution to be the coordination and promotion of efforts to attain higher professional standards of education and practice, greater solidarity of the engineering profession and greater effectiveness in dealing with technical, economic and social problems. The method of the Council's operation is by the development of procedures to be recommended to the sponsoring organizations and the administration of such procedures as are approved, functioning through standing committees on Student Selection and Guidance, Engineering Schools, Professional Training, and Professional Recognition, or through such new committees as may be established. One of the functions of this very influential organization has been the continued study and accrediting of University engineering curricula for the benefit of its member societies, prospective engineers and the profession and public in general.

The Institute's President, Col. L. F. Grant was, until recently, our representative on the Student Selection and Guidance Committee of the E.C.P.D. In the normal rotation of committee membership he has been succeeded by Dr. G. R. Langley of Peterborough who is chairman of the Institute's Committee for the Young Engineer. Dean C. R. Young of the University of Toronto represents the Institute on the Committee on Professional Training, and others of our members who are or have been actively associated with the Council on the Institute's behalf are de Gaspé Beaubien, R. DeL. French, and J. A. Ouimet, Montreal, J. A. Vance, Woodstock, Ont., E. V. Buchanan, London, Ont., K. M. Cameron, Ottawa, and J. W. Brooks, Kingston, Ont.

LIST OF NOMINEES FOR OFFICERS

The report of the Nominating Committee, as accepted by Council at the meeting held on September 20th, 1947, is published herewith for the information of all corporate members as required by sections 19 and 40 of the by-laws:

President	J. N. Finlayson	Vancouver
Vice-Presidents:		
*Zone "B" (Prov. of Ont.)	J. A. Vance	London
*Zone "C" (Prov. of Que.)	Alex. Lariviere	Quebec
*Zone "D" (Maritimes)	I. P. Macnab	Halifax
Councillors:		
†Cape Breton Branch	W. A. MacDonald	Sydney
†Halifax Branch	L. E. Mitchell	Dartmouth
†Moncton Branch	W. C. MacDonald	Moncton
†Quebec Branch	E. D. Gray-Donald	Quebec
‡Montreal Branch	J. M. Crawford	Montreal
	H. F. Finnemore	Montreal
†Cornwall Branch	Drummond Giles	Cornwall
†Ottawa Branch	G. R. Turner	Ottawa
§Toronto Branch	E. A. Cross	Toronto
†Hamilton Branch	W. A. T. Gilmour	Hamilton
†Peterborough Branch	A. R. Jones	Peterborough
†Sarnia Branch	R. W. Dunlop	Sarnia
†Niagara Pen. Branch	P. E. Buss	Thorold
†Sault Ste. Marie Branch	L. R. Brown	Sault Ste. Marie
†Winnipeg Branch	D. M. Stephens	Winnipeg
†Lethbridge Branch	R. S. Lawrence	Lethbridge
†Calgary Branch	K. W. Mitchell	Calgary
†Victoria Branch	S. H. Frame	Victoria

*One vice-president to be elected for two years.
†One councillor to be elected for two years.
§One councillor to be elected for three years.
‡Two councillors to be elected for three years each.

MEETINGS OF INTEREST TO ENGINEERS

The Highway Research Board of the National Research Council, Washington, D.C., announces that its 27th annual meeting will be held from December 2nd to 5th at the National Academy of Sciences in Washington.

At last year's meeting 39 State Highway departments, 28 colleges, three Canadian Provinces and 13 nations other than Canada and the United States were represented, and attendance is expected to increase this year.

ENGINEERS' WIVES ASSOCIATIONS

In the June *Journal* we reported the organization of an Engineers' Wives Association in Ottawa, this being the second such group to be formed following the excellent example set by the original engineers' wives association in Winnipeg.

Although not wishing to abate any of the enthusiasm with which we made the announcement, we must ask the Ottawa ladies to step from second to third place in regard to date of organization only. We are advised by the Engineers' Wives Association of Calgary that their group, now numbering nearly 100 members, was formed on March 23rd, 1944, and that it reads with interest and pleasure of the organization of the Ottawa group, grants the Winnipeg ladies first place but definitely claims second place in the order of inauguration.

The *Journal* feels sure that no one will take the claims to organizational honors in any but the light vein intended by the claimants themselves. We commend the example of all three enthusiastic groups to the ladies of the remaining 25 Institute branches, in anticipation of being able to report at an early date, formation of other organizations of engineers' wives. We wish every success to the three associations now formed and will welcome news of their activities for reporting in the columns of the *Journal*.

ALL-TIME HIGH ENROLMENT IN ENGINEERING AT McGILL

Elsewhere, under " Personals ", readers will note a number of promotions and appointments in the engineering staff of McGill University. These changes are allied with preparations for the handling of a record number of engineering students during the coming session.

For those who may be concerned over the large numbers of engineers who will begin to graduate in a few years, the *Journal* reports that the Institute expects very shortly to undertake a survey of the situation. The first moves are already under way in the efforts of the Student Guidance Committee to educate prospective engineering students as to exactly what they may expect in embarking on an engineering career.

Another move is stated to be under way in the Universities themselves where it is being emphasized to students that, while the engineering course is an excellent one and its degree a valuable asset, engineers should not leave university with a fixed idea that they must, at all costs, be strictly engineers. If an engineering graduate finds, after he has left college, that he does not seem to fit into the engineering groove, the manner of thinking which should be one of the principal assets he has obtained from his engineering course will readily fit him for many other fields of endeavour and he need not feel that his degree is " wasted " if he does not push a slide rule or use a handbook constantly.

It is today possible to find graduate engineers in many fields not necessarily related to engineering and in very few cases do these men feel that the time spent in earning their degree has been lost.

ACTIVE STUDENT GUIDANCE COMMITEE AT MONTREAL BRANCH

Last year this committee held several highly successful symposia for high school students of the graduating classes. Two prominent engineers or educators would speak during the first hour, after which the meeting would be open for questions, answers and discussion. Attendance at each of the three meetings was about 175 students.

The commitee has also recently circularized a number of senior engineers in Montreal, asking them to serve on a panel for interviews of prospective engineering students. The response to the committee's request was almost 100 per cent, indicating that, in Montreal at least, senior engineers are most definitely interested in the next generation of the profession and that no student need enter upon engineering studies without ample advice as to what he may expect from the profession.

At this time, with unprecedented numbers of University students enrolling in engineering, the Montreal committee is actively trying to ensure that as many as possible of the prospective misfits are turned aside at the outset and that those who may make successful engineers are fully acquainted with the engineering picture.

LACHINE WATERWAY TO BE STUDIED

A board of engineers has been appointed by the Department of Transport to review the recommendations made in 1926 by a former board regarding the Lachine Section of the St. Lawrence waterway. The new board is to determine if the 1926 plan is still practicable or to submit an " alternative scheme, better adapted to secure the ends desired.

It is interesting to note that the three board members and their two assistants are all Institute members: R. A. C. Henry, M.E.I.C., Ottawa, Dr. Arthur Surveyer, M.E.I.C., Montreal, and Dr. T. H. Hogg, M.E.I.C., Toronto, form the membership of the board, and they will be assisted by Guy Lindsay, M.E.I.C., and C. W. West, M.E.I.C., both of the Department of Transport, Ottawa.

PRESSURE VESSEL RESEARCH PROGRAMME

The Engineering Foundation's Welding Research Council is to undertake a research programme to cost $75,000 per year, directed toward improvements in safety and economy in the construction of welded pressure vessels.

The general committee for the project is made up of 87 representatives of manufacturers and users of pressure vessels, insurance companies, educational institutions and branches of the U.S. government. The principal financial support is being provided by interested manufacturers and users of pressure vessels.

The studies will cover four phases of the problem, viz:— design, fabrication, materials, and inspection and testing, with the first two receiving the greater emphasis in this, the first year of the programme. Work is already in progress at Purdue and Lehigh Universities.

At the Meeting of Council held at Headquarters on September 20th, the following Elections and Transfers were effected:—

Members

Bannerman, Eugene Campbell, B.Sc., (Mech.), Nova Scotia Tech., asst. chief engr., Bathurst Power & Paper Co., Bathurst, N.B.
Beeching, Thomas Arthur George, B.A.Sc., (Elect.), British Columbia, sales engr., Brown Boveri (Canada) Ltd., Montreal Que.
Brown, Archibald Maxwell, National Diploma (Ordinary), Rutherford Tech. College, Eng., genl. mgr. and dir., C. A. Parsons of Canada Ltd., Toronto, Ont.
Buckle, Charles Wilfrid, asst. engr., Dominion Public Works, New Westminster, B.C.
Dimond, Arthur William, B.Sc., (Chem. Engrg.), Alberta; research engr., Burgess Battery Co., Niagara Falls, Ont.
Hicks, Richard William, B.Sc., (Elect.), Manitoba; sales engr., W. W. Hicks & Co., Winnipeg, Man.
Kenny, Brian Mansell, asst. general sales mgr., Waterous Limited, Brantford, Ont.
Matthews, Harold, chief engineer, Vancouver Iron Works Limited, Vancouver, B.C.
Tregaskes, Norman Ernest, B.A.Sc., Toronto, asst. engr., hydraulic dept., H.E.P.C. of Ontario, Toronto, Ont.
Waddington, John Stanley, B.Sc., (Elect.), Manitoba, chief engr., Phillips Electrical Works, Brockville, Ont.

Juniors

Gain, John Charles Clare, B.A.Sc., (Chem. Engrg.), Toronto, 69 MacKay Ave., Toronto, Ont.
Parr, John Vernon, B.A.Sc., (Elect. Engrg.), Toronto, junior project engr., Windsor, Ont.
Percival, Edward Abbe, B.A.Sc., (Civil Engrg.), Toronto, 206 St. Clair Avenue, West, Toronto, Ont.
Turner, John Harris, B.A.Sc., (Metall.), Toronto, development & engrg. dept., Canadian Liquid Air, Montreal, Que.
Whelan, Henry Joseph, B. Sc., (Mech.), Saskatchewan, mech. engr., project and industrial, British American Oil Limited, Toronto, Ont.

Transferred from the Class of Junior to that of Member

Bradshaw, Thomas Earl, B.Sc., (Elect.), Manitoba, asst. sales and service mgr., Bedard-Girard Limited, Montreal, Que.
Simpson, Jack Lloyd, B.Sc., (Civil), Alberta, Engineered Buildings (Man.), Limited, Winnipeg, Man.

Admitted as Students

Bird, George, (Toronto), East York, Ont.
Christie, William Borden, (Dalhousie), Halifax, N.S.
Crawford, Donald Raymond, (Toronto), Woodstock, Ont.
Dickson, William Joseph K., (McGill), Montreal, Que.
Ennis, Gerard Joseph, (McGill), Montreal, Que.
Hardman, Laurie Edward, (McGill), Montreal, Que.
Hodge, Robert Charles, (McGill), Montreal, Que.
Jain, Parushottam Lal, (McGill), Montreal, Que.
Scott, James Chalmers, (Toronto), Fort William, Ont.
Smith, Basil Audley James, (McGill), Montreal, Que.
Smolensky, Benjamin, (Saskatchewan), Saskatoon, Sask.
Valere, Eric Arthur Boniface, (McGill), Montreal, Que.
Watson, James Keatley, (Queen's), Montreal, Que.
Williams, Joseph Sidney, (Nova Scotia Tech.), Halifax, N.S.
Yeadon, Dale Everett, (Nova Scotia Tech.), Halifax, N.S.
Yule, Robert Edward, (Queen's), Hamilton, Ont.

By virtue of the cooperative agreements between the Institute and the associations of professional engineers, the following elections and transfers have become effective:

Alberta

Members

Henderson, Donald Winslow, B.Sc., (Mech.), Saskatchewan, sales engrg., Wilkinson & McClean Ltd., Calgary, Alta.
Woodford, Raymond Sven, B.Sc., Alberta, asst. genl. supt., chemical & fertilizer divn., Alberta Nitrogen, Consolidated Mining & Smelting Co. of Canada, Calgary, Alta.

Junior

Klompas, Nicholas, B.A.Sc., (Mech.), British Columbia, engr., mech. branch, Department of Public Works, Edmonton, Alta.

Junior to Member

Monkman, Beverley Andrew, B.Sc., (Civil), Alberta, resident engr., i-c constrn. hydro development, Calgary Power Limited, Seebe, Alta.
Paterson, Raymond Gordon, M.Sc., Colorado School of Mines, prod. engr., Canadian Western Natural Gas, Light, Heat & Power Co., Ltd., Calgary, Alta.
Stothert, Winston Dunderdale, B.Sc., (Elect.), Alberta, electrical inspector, Government of Alberta, Calgary, Alta.

Saskatchewan

Members

Fisch, Gerald Gerhard, B.Sc., (Agric.), McGill, plant engr., Saskatchewan Minerals, Chaplin, Sask.
Roberts, Arthur Hugh, B.Sc., (Ceramic), Univ. of Illinois, consultant & development engr., Saskatchewan Clay Products, Estevan, Sask.

Juniors

Pantel, Edmund Herman, B.Sc., (Mech.), Saskatchewan, asst. dftsman., Canadian General Electric, Peterboro, Ont.
Wise, Jack Myron, B.Sc., (Mech.), Saskatchewan, power plant layout and design engr., Sask. Power Commission, Regina, Sask.

Junior to Member

Berry, William Murray, B.Sc., (Civil), Manitoba, hydraulic engineer, P.F.R.A., Regina, Sask.
Mollard, John Douglas Ashton, B.Sc., (Civil); Saskatchewan, M.Sc., (Civil Engrg.), Purdue Univ., Lafayette, Ind.; hydraulic engr., P.F.R.A., Regina, Sask.

Student

Doxsee, Donald Egerton, Univ. of Saskatchewan, 3304 College Ave., Regina, Sask.

New Brunswick

Members

Sharpe, Walton Kemp, B.A.Sc., (Civil), Toronto, sanitary engr., Dept. of National Health and Welfare, Maritime district, Saint John, N.B.
Trites, Charles Venor, Squadron Leader, Mtce. Command Headquarters, R.C.A.F., Ottawa, Ont. (Richibucto, N.B.).

Nova Scotia

Members

Kirkpatrick, Lesmere Forrest, B.Eng., (Mech.), Nova Scotia Tech., res. engr., (new power plant), Canada Electric Co., Ltd., Amherst, N.S.
Thompson, E. A., town engineer, Bridgewater, N.S.

Quebec

Members

Bardsley, John Albert, asst. to chief engr., Howard Smith Paper Mills, Montreal, Que.
Blueth, John Hans, Mech. Engr., Higher State Tech. Coll., Nurenburg, power plant design engr., Canadair Limited, Cartierville, Que.
Brooke, Edward Hugh, B.Sc., (Chem. Engrg.), Alberta, asst. to chief engr., refining dept., McColl-Frontenac Oil Co., Ltd., Montreal, Que.
Zabinski, John, B.A.Sc., (Chem. Engrg.), British Columbia, sales and service engr., National Heating Products, Montreal, Que.

Junior

Stewart, John William, B.Eng., (Mech.), McGill, mech. engr., Dominion works, Steel Co. of Canada, Montreal, Que.

ERRATUM

AXOMETRIC PROJECTION, by A. L. C. ATKINSON, M.E.I.C.

It has been brought to our attention that a serious mistake was made in the printing of Professor Atkinson's paper, "Axometric Projection", in the September *Journal*.

Equation I at the top of page 435 should read

$$(S_L)^2 + (S_B)^2 + (S_D)^2 = 2 \text{ and not } (S_L)^2 = (S_B)^2 = (S_D)^2 = 2$$

The *Journal* regrets this error and the inconvenience it will have caused to readers of Professor Atkinson's paper.

Personals

News of the Personal Activities of members of the Institute

Dr. F. H. Sexton, M.E.I.C., was awarded the honorary degree of doctor of civil laws by Mount Allison University at its convocation in May last. Dr. Sexton, who was president of Nova Scotia Technical College since its inception in 1907 until his retirement this year, and who held other offices of responsibility, including that of director of technical education for the Province of Nova Scotia, was awarded an honorary membership in the Engineering Institute last May.

Colonel R. D. Harkness, M.E.I.C., vice-president and general manager, and director of the Northern Electric Company Limited, Montreal, has been elected to represent industry on the advisory council of the International Bank for Reconstruction and Development. He will serve on the Advisory Council for two years.

A. G. Graham, M.E.I.C., supervisor of the Regional Planning Division of the Province of British Columbia, remains in that post on the transfer of the division from the Bureau of Reconstruction to the Department of Municipal Affairs. The former, which was responsible to the recently dissolved Reconstruction Committee of the Executive Council of the B.C. Government, has been reorganized, and its sections assigned to other departments.

J. R. Whigham-Teasdale, M.E.I.C., has retired from the services of the Department of Municipal Affairs of the Province of Alberta. He joined the department in 1942, coming from Drumheller, Alta., where for many years he had maintained a private consulting practice in engineering and contracting and in mine surveying.

John P. Messervey, M.E.I.C., was recently appointed deputy minister of mines for Nova Scotia. He has been acting deputy minister since May last, when he replaced Dr. Allan E. Cameron, M.E.I.C., who resigned the post to become president of Nova Scotia Technical College. Mr. Messervey joined the Nova Scotia Mines department in 1924 as an inspector, after 14 years service with various mining concerns in the United States and Canada. He was appointed mining engineer for the department in 1939, and assistant deputy minister early this year.

F. G. Goodspeed, M.E.I.C., superintending engineer at headquarters of the Dominion Department of Public Works, Ottawa, Ont., was promoted in May last to the position of assistant chief engineer. He joined the department in 1904, to work on the Georgian Bay Survey and was transferred to district offices at Saint John, N.B., and Edmonton, Alta. In 1913 he returned to Saint John as district engineer on harbours and rivers. Eight years later he became senior assistant engineer of that district, and in 1924 he was promoted to district engineer at Winnipeg. His appointment as superintending engineer at headquarters took place in 1937.

G. J. Dodd, M.E.I.C., is promoted to the post of professor of civil engineering at McGill University, Montreal. He is a graduate of McGill and has been on the staff since 1913, with the exception of five years service in World War I. He was appointed assistant professor in 1927 and associate professor in 1932.

Nine Canadians who played top roles in Canada's war effort were honoured recently with decorations of the government of the United States. Members of the Institute who received awards were:

Air Marshal G. O. Johnson, M.E.I.C., cited for exceptionally meritorious service from December 1941 to May 1945 as deputy chief of air staff. He received the Legion of Merit award, degree of Commander.

Air Vice-Marshal E. W. Stedman, M.E.I.C., having rendered exceptionally meritorious service in the field of scientific research and development, also received the Legion of Merit award, degree of Commander.

Lt.-Col. Donald Waldock, M.E.I.C., of the Canadian Army, assisted in effecting the exchange of detailed information between this country's laboratories and the United States Army Signal Corps in connection with development and procurement of modifications to existing ground radar equipment. He was awarded the Legion of Merit, degree of Officer.

Group Captain S. W. Coleman, M.E.I.C., who rendered outstanding services to the Government of the United States as chief staff officer to the Commander of the R.C.A.F. units in Newfoundland, also received the award of Officer in the Legion of Merit.

Rene Dupuis, M.E.I.C., is superintending engineer of operation at the Beauharnois Light, Heat and Power Company, Beauharnois, Que. He leaves the faculty of Laval University, Quebec, which he joined in 1942 as director of the department of electrical engineering. He had lectured in the mining and metallurgical department from 1940, while still engaged as assistant general superintendent of the Quebec Power Company. He is a past chairman of the Quebec Branch of the Institute.

A. G. Donaldson, M.E.I.C., the newly elected chairman of the Lethbridge Branch of the Institute for the 1947-48 season, was born in that city. He attended schools there, and studied at the University of Alberta, Edmonton, graduating with a B.Sc. degree in 1934. He had worked during summer vacations for the Federal Coal Company. On graduation he joined the Cadillac Coal Company to work as mine overman, and in 1935 he went to the Lethbridge Collieries Limited as mine superintendent. He was named to his present position as mine manager in 1946.

J. S. Campbell, M.E.I.C., has accepted the appointment as professor of mechanical engineering at Queen's University, Kingston, Ont. He recently resigned as assistant chief engineer for the Graham Paige Motor Corporation at York, Pa. He holds B.Sc. and M.Sc. degrees from Queen's, awarded to him in 1931 and 1933. His career has also included service as supervisor of the pricing and routing departments of Massey Harris in Toronto, and superintendent of the aircraft metal fittings division at Brantford, Ont.; work for D.I.L. in Montreal, and several years as chief engineer for the Canadian Top and Body Corporation Limited, Tilbury, Ont.

J. L. Balleny, M.E.I.C., of Canadian General Electric Company, has been appointed manager of its office at Trail, B.C. He joined the company's engineering staff at the Toronto works in 1925. Then for a few years he served with Dominion Bridge Company Limited, Montreal, and with the Beauharnois Light, Heat and Power Company. Returning in 1935 to Canadian General Electric at the Toronto head office he was manager of the Industrial Heating Section until his recent appointment.

J. M. Carswell, M.E.I.C., has been appointed assistant professor in the department of civil engineering at the University of Manitoba, Winnipeg. He had been with the Department of Reconstruction and Supply in Montreal from 1946, when he transferred from the Department of Munitions and Supply, Ottawa, where he was chief engineer of the central inventory records division.

C. James Gardner, M.E.I.C., has been appointed manager of Jessop Steel Company Limited and the Ajax Distributing Company Limited of Toronto and Montreal. He will be located at the Toronto head office. He was formerly chief of the machinery, metals and chemicals section of the Export Division of the Department of Trade and Commerce, Ottawa.

Olier Mathieu, M.E.I.C., is a division engineer at Montreal for the Roads Department of the Province of Quebec. He was previously located at L'Assomption, Que., as division engineer for the department since 1937.

J. Cecil McDougall, M.E.I.C., announces the formation of a new firm in Montreal. It will consist of Mr. McDougall, who is a past president of the Province of Quebec Association of Architects, and who has practised in Montreal for over thirty years; J. Roxburgh Smith, also a past president of P.Q.A.A., first vice-president of the Royal Architectural Institute of Canada; and Robert P. Fleming, a graduate of McGill School of Architecture.

J. W. Millar, M.E.I.C., is now superintendent of the Pacific Great Eastern Railway Company, Squamish, B.C. He was previously inspector for the Department of Railways of the government of British Columbia, and was located at Vancouver.

F. H. Johnson, M.E.I.C., formerly plant superintendent for the Truro Electric Commission, Truro, N.S., has joined the St. John Sulphite Company at Fairville, N.B. He is superintendent of power plants.

J. H. Sansfacan, M.E.I.C., who had been with the Beauharnois Light, Heat and Power Company since May of this year, has now been appointed assistant engineer of the city of Shawinigan Falls, Que. He went to Beauharnois from Montreal, where he was an engineer for the Dominion Department of Public Works.

Lieut. Col. W. D. Wishart, M.E.I.C., writes that for the next two years he will be attending the Military College of Science at Shrivenham, England. He has been in the Royal Canadian Corps of Signals since his graduation in 1931 from the University of Manitoba.

J. W. Brooks, M.E.I.C., has been appointed associate professor in civil engineering for Queen's University, Kingston, Ont. He graduated with honors in civil engineering from Queen's in 1939, and for two years he was demonstrator and lecturer in civil engineering there. He then went to H. G. Acres and Company at Niagara Falls, Ont., and from there to the Spruce Falls Power and Paper Company at Kapuskasing, Ont. At graduation he was president of the Civils Club, and is a member of the class '39 permanent executive. Since 1942 he has served, at the Institute's request, on the junior division of the Committee on Professional Training of the Engineers' Council for Professional Development.

W. E. Harrisan, M.E.I.C., is now employed by Wyandotte Chemicals, Detroit, Michigan. He was formerly chief instrument engineer for the Imperial Oil Limited at Sarnia, Ont.

Samuel Aboud, M.E.I.C., is with St. Maurice Valley Appliances Limited at Grand'Mere, Que. He was formerly with Northern Electric Company Limited, in Montreal, employed in the electronics division as supervisor of gauge design and dimensions control.

J. E. Boyle, M.E.I.C., has been appointed general manager of the Back River Power Company, Montreal. From 1945 he had been a staff engineer for Stevenson and Kellogg Limited, Montreal.

J. E. Brett, M.E.I.C., has established a consulting practice in Montreal, and he has been appointed sessional lecturer in civil engineering at McGill University. He is a graduate of McGill and was awarded a master's degree in structural engineering by the graduate school of engineering at Harvard University in February this year.

Harris J. Chapman, M.E.I.C., joined the Montreal engineering department of Canadian Industries Limited in July last. He was previously chief engineer of Clark Ruse Aircraft Limited, Moncton, N.B.

W. P. Graham, M.E.I.C., will be located in Montreal in the employ of Joseph Robb and Company. He leaves Imperial Oil Limited, for whom he was a technical service engineer at Sydney, N.S. He had also been located for a time at Moncton, N.B., as a lubrication engineer.

W. B. Karcheski, M.E.I.C., is now engineer with T. A. Burton and Company, engineers and constructors, St. Catharines, Ont. He was previously a designing draughtsman engineer with the Brompton Pulp and Paper Company Limited at Red Rock, Ont.

T. A. J. Leach, M.E.I.C., is in Victoria, B.C., with the Department of Lands and Forests, Water Rights Branch. He was previously resident engineer with the department of highways at Regina, Sask.

E. McK. Nason, M.E.I.C., has accepted employment with Water and Sewage Department of the City of Saint John, N.B. He was previously deputy city engineer at St. Catharines, Ont.

T. C. Powell, M.E.I.C., recently accepted employment with Canadian Johns-Manville Company Limited, Toronto, Ont., to do technical sales and service work, and will be stationed in Montreal after training. He was with C.I.L.'s Nylon Division at Kingston, Ont., with the position of production senior foreman.

M. G. Lariviere, Jr.E.I.C., is now with the consulting engineering firm of Surveyer, Nenniger and Chenevert, Montreal, as a designing and draughting engineer. He was previously with the Dominion Department of Public Works, located at New Westminster, B.C., and later at Ottawa, Ont.

Saul Feldman, Jr.E.I.C., is on the staff of the University of Toronto, as a demonstrator in the department of electrical engineering. He is also taking some post graduate courses. He received his B.Sc. degree in electrical engineering from the University of Manitoba in 1946 and was employed by Canadian Industries Limited at Windsor, Ont., until his recent appointment.

J. R. Mathiesan, Jr.E.I.C., formerly of the Fort William district office of the Department of Public Works of Canada, is transferred to the Toronto district office.

J. N. Siddall, Jr.E.I.C., is a graduate student at Massachusetts Institute of Technology, Cambridge, Mass. Until recently he was with National Research Council at Ottawa, as a junior research engineer. He is a University of Saskatchewan graduate, class of 1944, with a B.Sc. degree in mechanical engineering.

F. E. Ayers, Jr.E.I.C., has resigned from the Canadian National Railways to become City Engineer of Fort William, Ont. He was instrumentman at the Port Arthur division for C.N.R., since 1946 when he left the staff of the university of Saskatchewan where he was an instructor.

D. R. Brown, Jr.E.I.C., has been appointed to the staff of McGill University, as sessional lecturer in the department of mechanical engineering. He is a McGill graduate with a B.Eng. degree, class of 1944. He was a sub lieutenant with the R.C.N.V.R. until 1946 when he joined Canadair Limited, Montreal, in the design office.

L. A. Dakken, Jr.E.I.C., was transferred recently by his firm, Imperial Oil Limited, from Regina, Sask., to the Montreal East refinery. He was plant engineer at Regina.

Narman Epstein, Jr.E.I.C., is now a lecturer in chemical engineering on the staff of McGill University. He holds B.Eng. and M.Eng. degrees from McGill, the latter received in the fall of 1946.

M. M. Fainstat, Jr.E.I.C., has joined the staff of McGill University, as sessional lecturer in the department of mechanical engineering. He is a graduate of McGill, with a B.Eng. degree received in 1944. He is also a consultant to National Heating Products Limited, to which company he went after three years service with the R.C.E.M.E.

A. A. B. McMath, Jr.E.I.C., has joined the staff of Howard Smith Paper Mills Limited, Cornwall, Ont. He had been with the Foundation Company of Canada Limited at Montreal since 1945, when he transferred from Canadian Industries Limited at Brownsburg, Que.

Harold Callaghan Oatway, Jr.E.I.C., has been appointed assistant professor of mechanical engineering at McGill University, Montreal. A graduate of McGill, he did postgraduate work in London, England, at the Imperial College of Science and was awarded a diploma in aeronautics. He joined the R.C.A.F. in 1941, and was discharged in 1944 with the rank of squadron leader. Later he joined the staff of Canadair Limited, and went on loan to Douglas Aircraft Corporation, Santa Monica, California, as a stress analyst.

K. S. Sargent, Jr.E.I.C., formerly development chemical engineer with Naugatuck Chemicals at Elmira, Ont., recently joined the British American Bank Note Company as a chemical engineer. He is located at Ottawa, Ont.

William Tkacz, Jr.E.I.C., completed in June his studies at the University of Michigan and has received the degree of master of science in engineering (mechanical). At present he is a member of the staff of McKinsey, Kearney and Company, management consultants of Chicago, Ill.

J. L. Bateman, S.E.I.C., has left the Bell Telephone Company, Montreal, where he was assistant tool plans engineer, and is now with Engineering Installations, Montreal. He is a bachelor of science, electrical, University of Manitoba, 1946.

C. H. Denhez, S.E.I.C., who received the degree of B.A.Sc. in civil engineering from Ecole Polytechnique, Montreal, this year, is employed by Imperial Oil Limited at the Montreal East refinery.

C. H. Miller, S.E.I.C., is employed as a junior test and development engineer in the gas turbine engineering division of A. V. Roe Canada Limited at Malton, Ont. He was awarded the B.Eng. degree (mechanical) this year by Nova Scotia Technical College.

R. E. Johnson, S.E.I.C., who received a B.Sc. degree in civil engineering from the University of Manitoba this year, is employed by the Ontario Hydro Electric Power Commission at Toronto.

L. D. Offer, S.E.I.C., is in Melbourne, Australia, employed in the technical department of the Shell Company of Australia Limited. He joined the Shell Petroleum Company Limited, London, England, in 1946, after graduation from Queen's University with a B.Sc. degree in mechanical engineering.

J. E. Pickering, S.E.I.C., has accepted employment with Price Brothers Company Limited, Kenogami Que. He was formerly with the Polymer Corporation Limited, Sarnia, Ont.

Obituaries

The sympathy of the Institute is extended to the relatives of those whose passing is recorded here.

Archibald Murray, M.E.I.C., died at Wolfville, N.S., July 27th. He had lived at Wolfville for a few years only, following his retirement from the Civil Service at Ottawa. He was born at Yarmouth, N.S., in 1871, and he studied at Acadia University, Wolfville, and later at Harvard University, receiving a B.A. degree in 1904. He worked first with the Canadian Pacific Railway on location surveys, and from there went to Dominion Engineering Company, Montreal, to the City of Toronto, to Smith, Kerry and Chace, and from 1908 to 1910 he was assistant to the chief draughtsman at Mackenzie Mann and Company, Toronto. He was resident engineer for that company on the Montreal-Hawkesbury railway line and on the Toronto-Ottawa line.

During the first World War he went to England and was given a post in the Woolwich Arsenal and afterward spent some time teaching in the army of occupation on the Continent. After returning to Canada he was employed by the Canadian National Railway for a time, and later entered the Department of Railways and Canals at Ottawa as an assistant engineer. He spent a winter at Port Nelson, Man., transferring equipment to Churchill, Man., and returned to Ottawa in 1929. He did some work in connection with the survey of the St. Lawrence River for the Waterways Commission.

Mr. Murray joined the Institute in 1904 as a Student, becoming an Associate Member in 1914 and a Member in 1940. He was granted Life Membership in 1942.

Edwin Ronald Evans, M.E.I.C., died very suddenly at his home in Lewisville, N.B., on July 25, 1947. Mr. Evans was born at Hampton, N.B., in 1891, and received his education at Rothesay Collegiate and Mount Allison University. He commenced his professional career as engineer for the Montreal General Contracting Company on the deepening of the St. Lawrence River channel, near Gananoque, Ont. He was next engaged on hydrographic surveys in New Brunswick and Prince Edward Island. Given charge of surveys for the Moncton-Buctouche Railway, he also served as engineer in charge of realignment surveys and of maintenance of way. He was commissioned a lieutenant in the Royal Canadian Artillery in 1915, served overseas, won a captaincy, and was awarded the Military Cross. In 1919 he joined the Canadian National Railways, and was assistant engineer on construction of yard and engine facilities at Moncton, and resident engineer on the construction of the Halifax Ocean Terminal transit sheds and the new C.N.R. hotel and station at Halifax. He was acting harbour engineer at Moncton for C.N.R. in 1930 and in 1931 assistant engineer on the construction of the Saint John railway station. He entered private practice in 1933 at Lewisville, N.B., but two years later he joined the Parsons Construction Company Limited, Moncton, as building superintendent. In 1937 he rejoined the C.N.R. as resident engineer at Fredericton. In 1946 he accepted the position of assistant engineer for C.N.R. at Moncton which he held until his death.

Mr. Evans joined the Institute as an Associate Member in 1920 and became a Member in 1934. He was the immediate past-chairman of the Moncton Branch, and councillor-elect for 1948-49.

E. A. H. Menges, M.E.I.C., who for the past 21 years was chief engineer for the Disher Steel Construction Company Limited at Toronto, died on August 4th, 1947, at his home in that city. Born at Baden, Ont., he attended school there, and went to Toronto Technical School and the University of Toronto where he followed a special course in architecture and structural engineering. He was for five years an engineer in the city of Toronto architectural department, and from 1910 to 1925 he was chief engineer with Reid Brown Structural Steel and Ironworks Limited, Toronto. In 1926 he went to Disher Steel Construction Company Limited to take the position which he held at the time of his death.

He was a member of the Ontario Association of Architects, the Royal Architectural Institute of Canada, the Ontario Association of Professional Engineers and the Ontario Horticultural Society. He became an Associate Member of the Institute in 1930, transferring to Member in 1936.

C. C. Cariss, M.E.I.C., of Brantford, Ont., died in hospital in Toronto on September 9th, 1947. Mr. Cariss, who was chief engineer of Waterous Limited at Brantford, was born in Liverpool, England, in 1880. He was educated in England, and spent five years as an apprentice with Easton, Anderson and Goolden Limited at Erith, Kent. He was a veteran of the Boer War, having served with the Imperial Yoemanry.

He came to Canada in 1903 and was associated with E. Leonard and Son, London, Ont., as draughtsman and chief draughtsman until 1916. He went then to Waterous Limited and worked at first on general estimating. Later he supervised the boiler shop during construction of large marine boilers, and in 1920 he was made assistant chief engineer in charge of the drawing office. He became chief engineer in 1935.

He was a member of the Ontario Association of Professional Engineers, the American Society of Mechanical Engineers and the Grand Valley Group of Professional Engineers. From 1936 to 1946 he served on the Council of the Ontario Association. He joined the Institute as a Member in 1940.

News of the Branches

Activities of the Twenty-eight Branches of the Institute and abstracts of papers presented

BORDER CITIES BRANCH

G. W. Lusby, M.E.I.C. - - - *Secretary-Treasurer*
W. R. Mitchell, M.E.I.C. - - *Branch News Editor*

On Friday, Sept. 5, 1947, the Border Cities Branch of the Institute entertained President L. F. Grant and Mrs. Grant, and his party consisting of Vice-President W. R. Manock and Mrs. Manock; Vice-President W. L. Saunders, and Mr. J. A. Vance of the London Branch.

The party arrived in Windsor at noon and luncheon was held at the cafeteria of the Ford Motor Co. of Canada. The ladies were entertained at a luncheon held in the Prince Edward Hotel after which they were motored to the office of the Ford Motor Co. where they rejoined the president and his party for a tour of the plant.

In the evening a reception preceded the dinner held in the ballroom of the Prince Edward Hotel. The members were accompanied by their ladies. In the absence of the Chairman, A. D. Harris, the meeting was conducted by the Vice-chairman, J. M. Wyllie, who, after introducing those at the head table, called upon A. H. MacQuarrie to introduce President Grant.

The President remarked that he had met many old friends since arriving in Windsor. He referred to the feeling existing between the E.I.C. and the Professional Engineers of Ontario, and urged members of both organizations to cooperate. He said both organizations had done a lot for the engineer, and especially for the young engineer. Speaking of branch affairs, the president remarked that more technical papers should be presented by the members themselves and he urged the young engineer not to hesitate to criticise. The young engineer coming to the city should be brought to his first branch meeting as a guest of one of the members and introduced. As past chairman of the committee on the training and welfare of the young engineer, the president paid tribute to one of our members, H. D. Keil, for his splendid and most useful letter. Colonel Grant was concerned over the absorption of newly graduated engineers into the profession and stated that registration at Canadian Universities was three times normal. He felt that industry could absorb more engineers and that new men should be tarted in industry soon to acquaint themselves with the nany problems facing the profession.

Vice-Presidents Saunders and Manock spoke briefly of nstitute affairs and past vice-president J. A. Vance made a ew remarks including a word of praise for the branch's sup- ort of the Harry Bennett Fund.

T. H. Jenkins was also called upon for a few words. He old us of his early associations with Col. Grant.

On behalf of those present C. G. R. Armstrong thanked Col. Grant and the other members of his party.

After announcing the coming golf game and dinner with he Sarnia Branch at Lakewood Golf Club on Sept. 20th, he chairman declared the meeting adjourned.

HAMILTON BRANCH

L. C. Sentance, m.e.i.c. - - *Secretary-Treasurer*
I. M. Macdonald, jr.e.i.c. - *Branch News Editor*

The opening meeting of the Hamilton Branch, on the occa- ion of the President's visit, took place at McMaster University n September 10, 1947. Those in the presidential party were Lieut.-Col. and Mrs. L. F. Grant, Mr. and Mrs. W. R. Manock, nd Mr. W. L. Saunders. Chairman E. G. Wyckoff presided, nd after his opening remarks he called on H. A. Lumsden to ntroduce Col. Grant.

The existence in universities to-day of the largest number f student engineers in history, presents a challenge to all ngineers and to The Engineering Institute of Canada, the peaker declared. Many of the students are mature men with amilies to support, and on the whole, they are a good lot of uture engineers, who should be assisted by the profession nd the Institute.

The number of engineers in employment is increasing, but he rate of increase should be accelerated. This can be accom- lished by giving the profession a boost to prospective em- loyers. Another way in which new engineers will be taken nto industry is through the retirement of older men. About ixty per cent of engineers employed in industry are more han 50 years of age.

Col. Grant feels that the differences between the Institute nd the professional engineers association are regrettable, and hat the Institute should make every effort to understand the ssociation. He advocated that engineers should be members f both groups and should support both groups at every pportunity.

A vote of appreciation to the President was expressed by . R. Dunbar, and the officers and guests present were intro- luced. Vice-presidents W. L. Saunders and W. R. Manock, and Messrs. C. E. Sisson and J. A. Vance, spoke briefly.

The chairman announced that the next meeting will be a lant visit to the Steel Company of Canada on October 2nd, 947.

LONDON BRANCH

A. L. Furanna, m.e.i.c. - - *Secretary-Treasurer*
G. N. Scroggie, m.e.i.c. - *Branch News Editor*

On September 4th, the London Branch was favoured with a isit from the President of the Institute, Lieut.-Col. L. F. Grant, who was accompanied by Mrs. Grant, Vice-president W. R. Manock and Mrs. Manock, and Vice-president W. L. Saun- lers. The party was met at the station by Councillor and Mrs. V. A. Killop and Chairman and Mrs. H. A. McKay, who ac- ompanied them to their hotel. Here they were met at a uncheon by other members of the branch executive and their vives. In the afternoon, the party was driven around London o various places of interest, and later the ladies were enter- ained at a tea held at the home of Mrs. McKillop.

The dinner was held at the Wolseley Barracks Reserve Offi- ers' Mess, and members of the Military Engineers were asked o attend. Mr. McKay introduced all present at the head able, along with the Executive, after which the members in urn introduced themselves and their guests.

Colonel N. J. W. Smith, m.e.i.c., mess president, spoke brief- y, before the chairman called upon Mr. McKillop to intro- luce President Grant. The president spoke of the work and roblems of the Institute, and told of the high regard in which t is held by the American Societies. He went on to say that he younger men should be brought into the Institute and hat the older members should take a personal interest in hem, encouraging them to attend and take an active part in he branch functions and eventually to become members of he local executives.

Following the President's address, Mr. McKillop called upon Vice-Presidents Manock and Saunders, both of whom expressed their approval of the president's remarks and added their own along the same line of thought.

The speakers were thanked by J. A. Vance.

MONTREAL BRANCH

E. M. Van Koughnet, m.e.i.c. - *Secretary-Treasurer*

Of interest to the members of the Montreal Branch is the decision to hold a Dance instead of the usual Smoker. The Dance is tentatively scheduled for a Friday night during the month of February; the actual date is yet to be decided.

In addition to the arrangements for the opening meeting on October the 1st, the following papers will be presented during the month of October.

October 9th—**Research on Reinforced Concrete Structures.** Prof. F. E. Richard.
October 16th—**Engineering Street Lighting for Public Protection.** Stuart R. Williams.
October 23rd—**Executive Ability and its Development.** Dr. J. S. A. Bois.
October 30th—**Utilization of Wood at Gatineau.** G. D. Davidson.

On all paper nights, one or more members of the Reception Committee will be on hand with the object of assisting those present to obtain any information they may require.

THIRD ANNUAL DANCE
sponsored by the
Junior Section—Montreal Branch

Date: November 28th **Time:** 9 p.m.
Place: Ritz-Carlton Hotel **Price:** $2.50 per couple
Orchestra: Maurice Meerte

Tickets available from:
1. any member of the Executive.
2. the Institute, 2050 Mansfield Street.
2. Leo Scharry, Chairman, Entertainment Committee, Sangamo Company, Room 819, Tramways Bldg., Montreal. LA. 8193.

Due to the popularity of previous dances, the number of tickets to be sold will be limited. No tickets will be sold at the door.

Junior Section

Congratulations are extended to Denis Webb Stairs, McGill University and Jean Paul Dagenais, Ecole Polytechnique, winners of the E.I.C. Prize of $25.00 presented to their respective colleges. They will be presented with engraved certificates by President L. F. Grant at the opening meeting of the Branch on October 1st, 1947.

For the past two years the Junior Section has held an annual dance. This event has proved so popular, as evidenced by last year's attendance of over five hundred guests, that the Executive Council of the Junior Section has decided in favour of a 3rd Annual Dance which is scheduled for November 28th of this year. Plans have all been completed, the Ritz-Carlton Hotel Ball Room reserved and the services of Maurice Meerte's Orchestra obtained.

Due to the large attendance last year the sale of tickets will be limited and for this reason tickets will probably not be sold at the door. It is suggested that all those planning to attend should buy or reserve their tickets as soon as possible. They can be obtained through Leo Scharry, chairman of the Entertainment Committee, either by calling him at LA. 8193 or writing c/o Sangamo Company, Room 819, Tramway Building, Montreal. In addition tickets can be reserved or bought from any member of the Executive and a limited number will be held at E.I.C. Headquarters.

So don't forget November 28th, 9:00 p.m. at the Ritz-Carlton Hotel. Buy your tickets now so you will be sure not to miss a fine get-together.

OTTAWA BRANCH

C. G. Biesenthal, jr.e.i.c. - *Secretary-Treasurer*
R. C. Purser, m.e.i.c. - - - *Branch News Editor*

A field trip of the Ottawa Branch of the Engineering Institute and the Ottawa sub-section of the American Institute of Electrical Engineers, with members of the Ottawa Chapter of the Illuminating Engineering Society also as guests, was made on Saturday, September 13, to the Stewartville development on the Madawaska River, approximately eight miles south-west of Arnprior. About 100 engineers made the trip and were conducted in groups over the project under the general supervision of resident engineer, W. B. Crombie, of the Ontario Hydro-Electric Power Commission.

This development which will have an installed capacity of 81,000 electrical hp., under an operating head of 150 ft., and will cost about $10,500,000, was started in the fall of 1945. It is expected that the plant will be in operation during the summer of 1948. Approximately 50 per cent of the construction as a whole has been completed, including 30 per cent of the dam itself.

Included among the major items of construction is the excavation of 700,000 cu. yd. of material and the placing of 270,000 cu. yd. of concrete. The raising of the level of the Madawaska River as a result of the dam construction will necessitate the clearing of approximately 500 acres of land and the reconstruction of the Burnstown and Springtown bridges.

Maximum height of the concrete dam will be some 200 ft. and length 850 ft. A headworks will be incorporated near the northerly end of the dam, from which three 14-ft. steel penstocks approximately 190 ft. long will convey the water to three Francis type turbines in the power house at the base of the dam. A sluice-way provided with two 35-ft. sluice gates and two 14-ft. stop lug sluices will be placed at the southerly end of the dam, discharging during the flood period into a high-water channel on the south bank of the river. Concrete retaining walls will direct these flood waters to the exit channel of the diversion tunnel, in which baffle piers will absorb a large amount of the energy before the water re-enters the river below.

To de-water the power site the river has been diverted through a tunnel 30 ft. in diameter and some 500 ft. long, excavated under the site of the sluiceway section. The downstream and upstream cofferdams were constructed to cope with spring floods. The tunnel will be closed later by steel gates at the entrance portal and for final closure a concrete plug will be poured a short distance downstream from the portal.

Noon lunch was provided the engineers at the camp cafeteria. Major-General G. R. Turner, Chairman of the Ottawa Branch of the E.I.C., and G. R. Davis, Chairman of the Ottawa sub-section of the A.I.E.E., expressed the thanks of the party for the opportunity of visiting the development. On the return trip to Ottawa in the afternoon many of the engineers also availed themselves of the opportunity of visiting the Chats Falls power plant.

BRANCHE DE QUEBEC

Roger Desjardins, m.e.i.c. - - *Secrétaire-trésorier*
Charles Boisvert, m.e.i.c. - - *Editeur des nouvelles*

Le tournoi annuel de golf de la Branche de Québec eut lieu le 4 septembre, au Royal Quebec Golf Club, à Boischatel. Il y eut tournoi de 9 trous pour dames, tournoi de putting pour les dames ne jouant pas au golf, tournoi de 18 trous pour les messieurs. Près de soixante-dix concurrents et concurrentes prirent part aux différents concours. Au-dessus de 100 convives se groupèrent pour le souper et la danse qui suivirent les tournois au cours de la soirée. De nombreux prix furent distribués aux plus méritants, grâce aux généreuses souscriptions reçues de la part de compagnies et amis. Un sincère merci à tous ceux et celles qui ont contribué de près ou de loin au succès sans précédent du tournoi 1947.

Résultat complet: pointage entre parenthèses:

Messieurs:

1er. Brut, Ernest Gohier, m.e.i.c., (90), gagnant de la coupe E.I.C.,; 2e. Brut, P. A. Dupuis, président de la Branche, (92); 3e. Brut, Jos. A. Hamel, m.e.i.c., (93). 1er Net, J. des R. Tessier, m.e.i.c. (75), gagne la coupe Talbot; 2e. Net, Gustave St-Jacques, m.e.i.c., (75); 3e. Net, Arphyle Longpré, m.e.i.c. (76). 1er Brut, invité, Emile Cusson (95); 1er Net, invité, Jean Langevin (97). 4e. Brut, membre, Edouard DesRivières (93); 5e. Brut, membre, Ludger Gagnon (94). 4e .Net, membre, A. E. Paré (77); 5e. Net, membre, Gédéon Legault (77).

Ernest Roy remporta une main de poker avec quatre-six pour les trous 4-5-7-9-14. Gilles Sarrault remporta la main de poker formé des trous 3-5-7-11-13 avec quatre-six.

Chez les dames:

Tournoi de neuf trous: 1e. Mme F. Hyndman, pointage brut 55; 2e. Mme Ernest Roy, pointage brut 58; 3e. Mme C. E. Courchesne, pointage brut 63; 4e. Mme A. E. Paré, pointage brut 67.

Concours de putting: 1e. Mme J. des R. Tessier (16); 2e. Mme. P. A. Duchastel (18); 3e. Mme. Ed. DesRivières (21); 4e. Melle F. Desrochers (22).

Les autres participants aux différents concours furent: *Mesdames* C. O. Couillard, Robert Sauvage, Gérard Letendre, Ludger Gagnon, Louis Trudel, Henri Béique, J. U. Archambault, Léo Dufresne, Lionel Bizier, G. Sarrault, J. M. Paquet, Pierre Bricourt, Lionel Swift, Maurice Archer, René Rioux, P. A. Dupuis; *Messieurs:* Henri Savoie, H. F. Hyndman, R. L. Painchaud, C. E. Courchesne, Emilien Dagenais, Lionel Bizier, Robert Sauvage, Georges Demers, J. P. Drolet, René Rioux, Gilles Sarrault, Guillaume Piette, Paul Vincent, Louis Trudel, Marcel Levert, Maurice Ostiguy, Rolland Brosseau, Henri Béique, Maurice Archer, P. A. Duchastel, K. René Talbot, R. Wayland, Lucien Martin, C. O. Couillard, C. R. Yespelkis

Les prix de présence furent gagnés par Mlle G. Fortin, M. J. G. Laviolette et le Brigadier J. G. Francoeur.

Les confrères de la Branche ont eu l'agréable surprise de voir notre ami à tous, Louis Trudel, prendre part au tournoi. Il va sans dire que nous l'avons accueilli avec joie et espérons qu'il y prendra goût et sera des nôtres chaque année. Plusieurs amis de Montréal y étaient et nous les remercions de tout coeur pour leur appui toujours généreux.

Les membres doivent garder en mémoire la date du 28 novembre. Ce sera le bal du quarantième anniversaire de la Branche et la visite du Président.

ANNIVERSARY BALL AT QUEBEC

The Quebec Branch of the Institute celebrates this year its 40th anniversary. On this occasion, and during the presidential visit to the branch, a formal ball will take place at the Chateau Frontenac, on the 28th of November.

The Branch sincerely hopes that many members of other branches will join us for this celebration. We anticipate a big success as many members have shown their approval of the decision of the Executive Committee to commemorate the anniversary.

A hearty welcome is extended to all those who wish to join us. Remember the date: November 28th.

SARNIA BRANCH

F. F. Walsh, m.e.i.c. - - *Secretary-Treasurer*
J. E. Pickering, s.e.i.c. - *Branch News Editor*

In connection with the tour of President Grant to the Western Ontario branches of the Institute, a noon luncheon was held at Kenwick-on-the-Lake on Saturday, September 6th. The noon hour was chosen to allow the President's party to continue to Sault Ste. Marie aboard the *S.S. Noronic* that afternoon.

Lieut.-Col. and Mrs. Grant, W. L. Saunders, Ottawa, vice-president of the Institute, and past vice-president J. A. Vance of Woodstock were first taken on a tour of Sarnia which included visits to Polymer Corporation and Imperial Oil Limited Refinery.

Mr. Saunders addressed the meeting briefly, following which Mr. Vance introduced Col. Grant.

Col. Grant urged Institute members to cooperate to the fullest extent possible with the Association of Professional Engineers of Ontario. He also pointed out that the Council on numerous occasions had considered the merits of joining the Canadian Council of Professional Engineers and Scientists, but had rejected the proposal for good reasons.

The president sees no particular problem in the large number of engineering graduates anticipated in the next few years. Cooperation between industry and the profession will solve the situation, he believes. He also asserted that in his work on the staff of Queen's University he has found that a large number of engineering students do not intend to practice the profession on graduation. Many are using their war service gratuities and credits to take an engineering course, feeling that it is a form of training that would be advantageous in many fields. Small industries not now employing engineering graduates should be approached to see if it would not be profitable for them to do so. This would have the double benefit of probably increasing the efficiency of the industries concerned and also of ensuring that the trained graduates would remain in Canada. Col. Grant also urged all members to take a special interest in new members and new graduates who are arriving in the Branch.

The President's party at Sarnia. Standing, l. to r.: W. A. Williams of Imperial Oil Company, Councillor G. L. Macpherson, Mrs. L. F. Grant, E. W. Dill of Polymer Corp., Past Vice-president J. A. Vance, Lieut.-Col. L. F. Grant, Mrs. Dill. Seated, l. to r.: Mrs. F. F. Walsh, Secretary-Treasurer F. F. Walsh, Mrs. Williams, and Mrs. Macpherson.

Left to right: F. F. Dyer, chairman of Sarnia Branch, Mrs. Grant, Vice-president W. A. Saunders, Mrs. Dyer, President Grant.

The Affiliated Engineering and Allied Societies in Ontario, of which the Institute's Toronto Branch is a member group, are planning an Engineers' Dance for Friday, November 7th in the Auditorium of Eaton's College Street.

D. G. Geiger, M.E.I.C., Bell Telephone Company of Canada Limited, is chairman of the arrangements committee, and further information can be obtained by contacting him.

Library Notes

Book notes, Additions to the Library of The Engineering Institute, Reviews of New Books and Publications

BOOK REVIEW

HEAT PUMPS

Phillip Sporn, E. R. Ambrose, and Theodore Baumeister. John Wiley & Sons, New York, 1947. 188 pp., illus., 5½ x 8½ in., cloth, $3.75.

Reviewed by D. Lorne Lindsay, Jr. E.I.C.*

After more than twelve years of personal experience in the design of heat pumps for heating and cooling commercial buildings, the authors of "Heat Pumps" have prepared a well rounded text that will form an adequate guide for the heating and ventilating engineer who wishes to design heat pump installations.

The opening chapters of the book describe in detail the principles and basic designs of heat pump cycles. They show the variety and versatility of the equipment and describe the possibilities as well as the limitations of this rapidly developing form of heating.

Subsequent chapters cover fully the factors leading up to the choice of the components. Fans, coils, compressors, refrigerants and automatic controls are dealt with in very great detail. The operation of the system for both heating and cooling purposes is covered in one chapter with a good discussion on the defrosting of outside coils.

The industrial applications of heat pumps are mentioned and illustrations of American and Swiss applications of compressors operating on the heat pump principle are shown. Here the heat pump is being used very economically for the evaporation and sterilization of liquids, the drying of solids, and the simultaneous heating and cooling of materials in process.

The economic considerations are covered both from the point of view of the consumer and of the producer of power. The possible savings over the use of other fuels for domestic heating are shown based on prevailing costs and operating conditions. The power companies should find the data on the effect of the load on the power system of value as considerable information is presented relating to the effect of the heat pump load on the Electrical Utility System Load curve.

The authors have presented the information in great detail with very explicit instructions in the operation of the various cycles and in the selection and sizing of equipment. Unfortunately they have not been able to discuss the use of buried coils for heat source in winter. This type of condenser offers the greatest possibilities for installations in climates such as we enjoy in Canada.

The references at the end of each chapter are useful and the photographs and charts are clear and informative.

"Heat Pumps" should be of interest to all heating and ventilating engineers, and to refrigeration engineers, as it opens a new field to them. Manufacturers of refrigerating equipment will welcome this book for the information relating to this potential use of their equipment.

*Mechanical Engineer, G. Lorne Wiggs and Co., Consulting Engineers, Montreal, Canada.

NEW LIBRARY HOURS

For the convenience of the local members, the Reference Library will remain open until 6.00 p.m. Monday through Friday and Thursday evenings until 8.00 p.m. commencing October 1st. Books, etc., may be borrowed and the Library catalogues and indices consulted.

Regular Library Hours

Monday-Friday	9.00 a.m.— 6.00 p.m.
Thursday	9.00 a.m.— 8.00 p.m.
Saturday	9.00 a.m.—12.00 noon

Out-of-Town Members

Books, periodicals, photostats, etc., may be borrowed or purchased by any member of The Institute. Postal charges are paid by the borrower. A Five-dollar deposit fee is required before items may be borrowed. Subject bibliographies will be compiled on request. Detailed or extensive literary searches will be made at cost.

The Engineering Institute of Canada

PUBLICATIONS OF OTHER ENGINEERING SOCIETIES

Exchange arrangements exist between The Engineering Institute of Canada and engineering societies in the United States, United Kingdom, Australia, and New Zealand whereby members of the Institute may secure the publications of these societies at special rates which in most instances are the same as charged to their own members. A list of these publications with the amounts charged (not including bank charges and exchange) is given below. Subscriptions should be placed at E.I.C. Headquarters but no remittance should be made until an invoice has been received. These prices are subject to change without notice.

	Rate to E.I.C. Members	*Rate to Non-Members*
AMERICAN SOCIETY OF CIVIL ENGINEERS		
Proceedings, single copies	$ 0.50	$ 1.00
Per Year	4.00*	8.00†
(Plus 75c to cover foreign postage)		
Civil Engineering, single copies	.50	.50
Per Year	4.00	5.00
(Plus 75c to cover Canadian postage: $1.50 foreign postage)		
Transactions, per year	6.00‡	12.00¶
(Other publications 50 per cent reduction on catalogue price to E.I.C. members)		
**If subscription is received before Dec. 1st, otherwise $5.00.*		
†*If subscription is received before Dec. 1st, otherwise $10.00*		
‡*If subscription is received before Jan. 1st, otherwise $8.00.*		
¶*If subscription is received before Jan 1st, otherwise $16.00.*		
AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS		
Electrical Engineering, single copies	$ 0.75	$ 1.50
Per Year	6.00*	12.00*
(*Plus postage 50c.)		
Transactions—annual, bound	6.00*	12.00*
(*Plus postage 50c.)		
(The single copy price for Electrical Engineering includes postage charge.)		
THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS		
Mechanical Engineering, single copies	$ 0.50	$ 0.75
Per Year	4.00*	6.00*
(*Additional postage to Canada 75c, Outside United States and Canada, $1.50.)		
Transactions, bound, published annually, about March 1st (price of current volume)	10.00	15.00
(Other publications, same rate to E.I.C. members as to A.S.M.E. members.)		
Journal of Applied Mechanics—Quarterly publications.		
Dates of issue: March, June, Sept., Dec.	4.00*	5.00*
(*Plus postage 25c.)		
INSTITUTION OF ELECTRICAL ENGINEERS		
Proceedings and Journal (in Three Parts)		
Per Year	£1–11s–6d	£3– 3s–0d
Part I—General, Per Year	10s–6d	£1– 1s–0d
Part II—Power Engineering, Per Year	15s–9d	£1–11s–6d
Part III—Communications Engineering, Per Year	15s–9d	£1–11s–6d
Science Abstracts (in Two Sections)		
Per Year	£1–10s–0d	£3– 0s–0d
Section A—Physics Abstracts, Per Year	17s–6d	£1–15s–0d
Section B—Electrical Engineering, Per Year	17s–6d	£1–15s–0d
INSTITUTION OF ENGINEERS, AUSTRALIA		
Journal		
Per Year	£2– 2s–0d	£4– 4s–0d
NEW ZEALAND INSTITUTION OF ENGINEERS		
Proceedings—annual, bound	10s–6d	£1– 1s–0d

L. AUSTIN WRIGHT, *General Secretary*,
2050 Mansfield Street, Montreal 2.

ADDITIONS TO THE LIBRARY

TECHNICAL BOOKS, ETC.

Circuits and Machines in Electrical Engineering; 2nd ed.:
John O. Kraehenbuehl and Max A. Faucett. New York, Wiley, 1947. 2 vols., illus., cloth.

Control Charts; an Introduction to Statistical Quality Control:
Edward S. Smith. New York, McGraw-Hill, 1947. 161 pp., illus., cloth.

Data Book for Civil Engineers—Volume 1: Design:
Elwyn E. Seelye. New York, Wiley, c1945. 683 pp., illus., cloth.

Experimental Physics:
D. H. Bellamy. Brooklyn, Chemical Publishing Company, 1941. 255 pp., illus., cloth.

Freight Transportation for Profit:
Henry B. Cooley. New York, Cornell Maritime Press, 1946. 206 pp., illus., cloth.

Short History of the River Murray Works:
J. H. O. Eaton. Adelaide, Australia, River Murray Commission. 69 pp., illus., fabrikoid.

Simplified Engineering for Architects and Builders; 2nd ed.:
Harry Parker. New York, Wiley, c1947. 245 pp., illus., fabrikoid.

Steam Generation:
J. N. Williams. London, Evans, 1946. 372 pp., illus., cloth.

Surface Construction without Accidents; your Helping Hand when Trouble Comes:
American Mutual Liability Insurance Company, Boston, c1946. 81 pp., illus., fabrikoid.

Table of the Bessel Functions J_0 (z) and J_1 (z) for Complex Arguments, 2nd ed.:
Mathematical Tables Project, National Bureau of Standards. New York, Columbia University Press, 1947. 403 pp., illus., cloth.

Tables of Spherical Bessel Functions, volume 2:
Mathematical Tables Project, National Bureau of Standards New York, Columbia University Press, 1947. 328 pp., illus., cloth.

Treatise on Milling and Milling Machines, 3rd ed.:
Cincinnati Milling Machine Company, Cincinnati, 1945 and 1946. 2 sections, illus., paper.

Ultrahigh Frequency Transmission and Radiation:
Nathan Marchand. New York, Wiley, 1947. 322 pp., illus. cloth.

Wireless Direction Finding; 4th ed.:
R. Keen. London, Iliffe, 1947. 1,059 pp., illus., cloth.

TECHNICAL BULLETINS, ETC.

American Society for Testing Materials:
Preprints: *Annual Report of the Board of Directors.—No. 2—Report of Committee A-2 on Wrought Iron.—No. 30—Influence of Plastic Extension and Compression on the Fracture Stress of Metals, D. J. McAdam, Jr., G. W. Geil, and W. H. Jenkins.—No. 51—Procedures for Determining the Air Content of Freshly-Mixed Concrete by the Rolling and Pressure Method, Carl A. Menzel.—No. 53—Measurement of Air Entrained in Concrete, John H. Swanberg and T. W. Thomas.—No. 81—Report of Committee E-1 on Methods of Testing.—No. 99—Microworker for Lubricating Greases, George M. Hain.—No. 109—Field Loading Tests for the Evaluation of the Wheel-load Capacities of Airport Pavements, L. A. Palmer.—Evaluation of Test Methods for the Determination of Dissolved Oxygen in Deaerated Boiler Feedwater, J. F. Sebald.*

Canada. Bureau of Mines. Publications:
No. 819—Industrial Waters of Canada: Report on Investigations 1934-1943, Harald A. Leverin.—No. 822—Physical Properties of Canadian Structural Tile (Made from Clay or Shale), J. G. Phillips and G. A. Kirkendale.

Electrochemical Society:
Preprints: *91-35—Corrosion in the Tropics, K. G. Compton.—92-2—X-Ray Diffraction Study of Manganese Dioxide, by W. F. Cole, A. D. Wadsley, and Allan Walkley.—92-3—Electrode Potentials of Carbon in Acid Electrolytes, N. M. Winslow.—92-4—Observations of Crystal Structure and Particle Shape in Electron Micrographs of Several Carbon Blacks John H. L. Watson.*

National Research Council:

N.R.C. No. 1516—Ultra-Violet Absorption Spectrum of Anhydrous Nitric Acid.

Princeton University. Industrial Relations Section. Selected References:

No. 17—Employee Benefits in Collective Bargaining.

STANDARDS, SPECIFICATIONS, ETC.

British Standards Institution. Specifications:

1369:1947—Metal Lathing (Steel) for Plastering.—1371:1947—Microfilm, Readers and Reels.—1384:1947—Measurement of Photographic Transmission Density.—1386:1947—Copper Tubes to be Buried Underground.—1387:1947—Steel Tubes and Tubulars Suitable for Screwing to B.S. 21 Pipe Threads.—1393:1947—Reinforced Diamond Dies for Wire Drawing.

Canadian Standards Association. Specifications:

C22.1-1947—Canadian Electrical Code, Part I (Fifth Edition): Essential Requirements and Minimum Standards Governing Electrical Installations for Buildings, Structures and Premises.—C22.3 No. 1—Canadian Electrical Code, Part III: Overhead Systems.—C22.3 No. 1 (C)—Rules, Requirements and Specifications for the Construction of Supply Lines Crossing Communication Lines.—W 48-1947—Standard Specification for Iron and Steel Arc-Welding Electrodes.

PAMPHLETS, ETC.

Electrical Engineering as a Career:

F. L. Lawton. Montreal, Engineering Institute of Canada, 1946.

Engineering Teacher; Keystone of the Profession:

Louis H. Berger. Boston, Berger, c1947.

Erosion due to Incipient Cavitation:

W. T. Bottomley. London, Institution of Mechanical Engineers, 1947.

Fatigue Strength of some Magnesium Sheet Alloys:

L. R. Jackson and H. J. Grover. Philadelphia, American Society for Testing Materials, 1946.

Gases Causing Unsoundness in Copper-Base Alloys:

L. W. Eastwood and J. G. Kura. Columbus, Ohio, Battelle Memorial Institute, 1947.

New and Accelerated Methods Applied to Engineering Procedures:

Louis H. Berger. Boston, Berger, 1946.

Provincial Labour Standards Concerning Child Labour, Holidays, Hours of Work, Minimum Wages, and Workmen's Compensation:

Ottawa, Department of Labour, 1947.

Recent Developments in the Design of the Sulzer Marine Engine:

J. Calderwood. Winterthur, Switzerland, Sulzer, 1947.

Shawinigan Water and Power Company:

Shawinigan, Montreal, 1947.

Sulzer Marine Engines; Crosshead Type for Direct Drive:

Sulzer, Winterthur, Switzerland, 1947.

BOOK NOTES

The Institute does not assume responsibility for any statements made; they are taken from the preface or the text of the books.

Prepared by the Library of The Engineering Institute of Canada

AMERICAN WELDING SOCIETY STANDARD SPECIFICATIONS FOR WELDED HIGHWAY AND RAILWAY BRIDGES, 4th ed. D 2.0-47:

New York, American Welding Society, 1947. $1.00

These specifications are intended for the application of metal-arc welding to the fabrication, field assembling and repair of highway and railway bridges. The new edition introduces a new concept in design formulas. These are prescribed for both base material and welded connections according to the expected number of repetitions of loading which would produce maximum stress in a member. The specifications also include requirements for material, design details, workmanship and inspection.

AMERICAN WELDING SOCIETY TENTATIVE SPECIFICATIONS FOR CORROSION-RESISTING CHROMIUM AND CHROMIUM-NICKEL STEEL WELDING ELECTRODES. A 5.4-46T:

New York, American Welding Society, 1946. 25c.

These specifications prescribe requirements for the more commonly used covered chromium and chromium-nickel steel electrodes yielding deposited weld metal in which chromium exceeds 4% and nickel does not exceed 50%. The test requirements of these specifications establish minimum quality levels which will assure suitability of the electrode for the usual applications. The Guide appended to these specifications describes the more common applications and suggests test procedures should the intended application warrant additional tests.

BRITISH STANDARD CODE OF PROCEDURE IN INSPECTION OF COPPER-BASE ALLOY SAND CASTINGS. B.S. 1367-1947:

London, British Standards Institution, 1947. 2/6.

This code of procedure is meant to give the maximum possible information on the properties of sand castings with reasonable expenditure of materials, time, and labour. It is intended to standardize inspection procedure and to indicate the significance and value of various steps in inspection procedure. It may be used in conjunction with British Standards and other specifications for alloys.

BRITISH STANDARD SPECIFICATION FOR ARCHITECTS', ENGINEERS' AND SURVEYORS' BOXWOOD SCALES. B.S. 1347-1947:

London, British Standards Institution, 1947. 2/.

This British Standard was prepared in collaboration with the Drawing Office Material Manufacturers' and Dealers' Association. Boxwood scales and boxwood scales with celluloid edges, of oval, flat, and triangular section are described and illustrated; the minimum and maximum values of the principal dimensions are listed; materials, workmanship, dividing and figuring are specified, and open divided and fully divided scales are defined and illustrated. Architects', engineers' and surveyors' scales which are considered as standard scales, are tabulated in five tables, and these include decimal and metric scales. Recommended combinations of scales, or divisions of scales, follow and these include drafting machine scales.

BRITISH STANDARD SPECIFICATION FOR BLACK CUP AND COUNTERSUNK BOLTS, NUTS AND WASHERS. B.S. 325-1947:

London, British Standards Institution, 1947. 2/.

The revision of this standard is primarily to give effect to certain desirable changes in the proportions of bolt heads, especially the adoption of two uniform angles of countersunk in place of the variety of angles formerly standardized. The nuts standardized in this revision are those now established for general engineering in B.S. 916-1946. The Standard includes a full range of round and square washers with round and square holes for use with these bolts.

BRITISH STANDARD SPECIFICATION FOR DIMENSIONS OF UNSCREENED MAGNETOS. B.S. 5027-1947:

London, British Standards Institution, 1947. 3/6.

This is a revision of the 1924 Standard, and deals with the dimensions of base mounted and spigot mounted unscreened magnetos, of the E, G, K, and M types, in particular to those dimensions which affect the interchange of magnetos. It sets out overall dimensions and fixing dimensions, sizes of tapers and keyways, and defines the position of the keyways on armature spindles.

BRITISH STANDARD SPECIFICATION FOR HARD-DRAWN COPPER SOLID AND STRANDED CIRCULAR CONDUCTORS FOR OVERHEAD POWER TRANSMISSION PURPOSES. B.S. 125-1947:

London, British Standards Institution, 1947. 2/.

This standard is a revision of the one published in 1924. It prescribes the standard values for the physical constants of hard-drawn copper, and standard resistances, weights and sizes and mechanical properties and the testing of joints in the conductors are stated, and the international standards of resistance for copper are given in an Appendix.

BRITISH STANDARD SPECIFICATION FOR THE DIMENSIONS FOR IGNITION AND LIGHTING UNITS FOR MOTOR CYCLES. B.S. 1368-1947:

London, British Standards Institution, 1947. 3/6.

This specification provides overall dimensions and fixing dimensions for the following ignition and lighting units used in connection with motor cycles: combined dynamo and magneto units (double spindle type), combined generator and ignition units (single spindle type), combined dynamo and engine speed contact breaker units, and dynamos. Besides overall and fixing dimensions, it sets out sizes of tapers and keyways, defines the position of the keyways on armature spindles and includes tolerances applicable to those dimensions which affect interchangeability.

BRITISH STANDARD SPECIFICATION FOR SHIPS' SIDE SCUTTLES. B.S. 3024-1947:

London, British Standards Institution, 1947. 3/6.

This specification provides for the materials, scantlings, and testing of ships' side scuttles of non-opening and opening types in passenger and non-passenger ships, and includes general requirements with respect to workmanship.

BRITISH STANDARDS FOR WORKSHOP PRACTICE. B.S. Handbook No. 2, 1946:

London, British Standards Institution, 1946. 12/6.

This handbook is a revised edition of the 1943 handbook and reproduces the technical data, diagrams and dimensions from forty British Standards relating to limits and fits; screwthreads, including metric threads and some information on American threads; pipe threads; designs and tolerances for plain and threaded gauges; bolts, nuts, machine screws and washers; small rivets; small tools such as screwing taps, milling cutters, reamers and drills; drilling jig bushes; butt-welded lathe and planer tools; keys, keyways, coned-end shafts, splines and serrations; ball and parallel-roller bearings; and certain details of machine tools, such as milling machine spindles, lathe spindle flanges, and spindle noses for grinding machines. In addition there is a section giving extensive data on cast iron and steel, whilst some useful general tables are included relating to hardness numbers, wire gauges, and metric conversions.

BRITISH STANDARD SPECIFICATION FOR WROUGHT MAGNESIUM ALLOYS. B.S. 1350-1357. 1947:

London, British Standards Institution, 1947. 3/6-.

This is a continuation of British Standards 1272-1280-1945, which covered magnesium alloy ingots and castings. It includes magnesium alloys in the following wrought forms: forgings, press forgings and stampings; sheet and strip; bars and sections; tubes. Each section is complete and contains clauses covering chemical composition, mechanical properties, and test requirements. Difficulty has been experienced in arriving at the limits for some of the impurities in view of the lack of information that exists, but the Committee proposes to review the standards when further information is available.

GEOLOGY FOR ENGINEERS, 2nd ed.:

F. G. H. Blyth. London, Arnold, 1945. 329 pp., illus., 8¾ x 6 in., cloth, $6.50.

This is the second edition of GEOLOGY FOR ENGINEERS which was published in 1943, and includes new matter relating chiefly to rivers and alluvium, marine action and coastal works, and glacial deposits. The object is to give some knowledge of geology to the civil engineer, so that he is in a position to carry out simple geological investigations encountered in his daily work. The book presents the broad content of the science, viewed from the geologist's standpoint, and supplemented by discussion of selected cases from engineering practice which illustrate the applications of the science to the art. References for further reading are included.

INSTALLATION AND MAINTENANCE OF AIR COMPRESSORS:

D. Braid. Manchester, Emmott, 1947. 50 pp., illus., 7¼ x 4¾ in., paper, 2/6-.

The purpose of this monograph is to interest the users of compressed air in the equipment which provides this convenient form of power transmission. It includes the selection and arrangement of Air-compressor sites—choice and position of site; coal, dust-free air; filters; air receivers; silencing; foundations, setting out and pouring; use of bedplates;—the erection—checking the machines on arrival; checking foundation; erection on foundation; grouting in; lining up; pulleys, couplings, flexible couplings, single bearing motors; crankshaft deflection; dowelling;—the starting up—lubrication, choice of oil; splash lubrication; mechanical lubricators; preparation for first run; cooling water; direction of rotation; heating up of bearing, etc.; running in; stage pressures and temperatures; log book.

MANAGEMENT AND MORALE:

F. J. Roethlisberger. Cambridge, Mass., Harvard University Press, 1946. 194 pp., 8½ x 5¾ in., cloth, $3.25.

The social organization of industry, and the skills needed in dealing with it, are discussed in this re-examination of the prevalent beliefs and practices regarding problems of obtaining co-operation and morale in modern industrial organizations. The book is addressed to business executives and, more generally, to the intelligent public. The study, which is developed in some detail serves to demonstrate that collaboration cannot be left to chance, that by inadvertence we have done exactly this for more than a century, and that it is this neglect more than any other determination which has issued in the present chaos. Roethlisberger shows that there are methods, not at any point in conflict with the democratic tradition, that may be applied to the remedy of our social and industrial ills.

PUBLIC WORKS ENGINEERS' YEARBOOK-DIRECTORY, 1946:

American Public Works Association, Chicago, 1946. 252 pp., illus., 8½ x 5½ in., cloth.

This book is a resume of the activities of the American Public Works Association, and includes reports of the Association and its committees. Papers on engineering problems in the public works field, several with good bibliographies, are included, and there is an alphabetical and a geographical list of members.

The following book notes appear here through the courtesy of the Engineering Societies Library of New York. The books may be consulted at the Institute Library.

ELECTRICAL ENGINEERING, PROBLEMS AND THEIR SOLUTIONS:

T. F. Wall. Chemical Publishing Co., Inc., Remsen Press Division, Brooklyn, N.Y., 1947. 312 pp., diagrs., charts, tables, 8¾ x 5½ in., cloth, $5.00.

This is the companion volume to "Principles of Electrical Engineering" and contains the problems and their solutions which complement the material found in the main volume. Some of the material needed for the solution of these problems is to be obtained from current literature. The problems vary from comparatively simple ones to those of considerable difficulty.

ELEMENTS OF ELECTRICAL ENGINEERING, A TEXT-BOOK OF PRINCIPLES AND PRACTICE:

A. L. Cook and C. C. Carr. 5th ed. John Wiley & Sons, New York; Chapman & Hall, London, 1947. 662 pp., illus., diagrs., tables, 9¼ x 6 in., cloth, $5.00.

Numerous changes and additions have been made in this fifth edition. Discussion of control generators, mathematical representation of vectors, dry-type transformers, saturable-core reactors, and synchros has been added. The chapter on electrical measuring instruments has been enlarged, and material on the fundamentals, characteristics, functions, and basic circuits of electron tubes, and the principles of application of electronic devices in industry have been included. The discussion of electric and magnetic circuits, d-c machinery, alternating currents and a-c machinery has been revised, and new illustrations used. The book is designed to satisfy the needs of both students in the electrical field and those who are not.

FREIGHT TRANSPORTATION FOR PROFIT:

H. B. Cooley. Cornell Maritime Press, New York, 1946. 206 pp., diagrs., tables, 9¼ x 6 in., cloth, $5.00.

Intended both for students and for the men actually engaged in the transportation field, this book gives new, efficient methods for profitable operation of air, water, truck and rail transportation companies. Special chapters are devoted to loading characteristics and selection of carrier, cost characteristics of commodities, cost determination for specific operations, labor costs, and competition in transportation.

HANDBOOK OF CHEMISTRY:

Compiled and edited by N. A. Lange, assisted by G. M. Forker, with an Appendix of Mathematical Tables and Formulas by R. S. Burington. 6th ed. rev. & enl. Handbook Publishers, Inc., Sandusky, Ohio, 1946. 1767 pp. plus Appendix of 271 pp. and Index, 28 pp., diagrs., charts, tables, 8 x 5½ in., fabrikoid, $7.00.

This comprehensive compilation of chemical data, while mainly of value to the professional chemist or student of chemistry, also provides a useful source of such information for workers in other fields. New subject matter in the present edition is as follows: modern concepts of matter; numerical values of the gas constant; composition of sea water. Two tables have been omitted as belonging properly to chemical engineering: pipes, valves and fittings; flow of water and gas in pipes. Of the considerable revision the most important change is the revised and enlarged table of physical constants of inorganic compounds which now includes 2603 compounds and, for the first time, gives data on refractive index. There is a 270 page mathematical appendix.

MODERN POLISHES AND SPECIALTIES, RAW MATERIALS AND MANUFACTURING METHODS:

W. D. John. Chemical Publishing Co., Brooklyn, N.Y., 1947. 313 pp., tables, 8¾ x 5½ in., cloth, $7.50.

The sources and properties of many types of waxes and polishes are given. Vegetable, mineral, insect, animal and synthetic waxes are discussed. Their uses as floor, furniture, and boot and shoe polishes, restorers and cleaners, liquid dyes, motor car polishes, window and glass cleaners, and household powders and cleaners are considered. The formulas of these polishes and cleaners are given with specific directions for manufacture in many cases.

POWDER METALLURGY, PRINCIPLES AND METHODS:

H. H. Hausner. Chemical Publishing Co., Inc., Brooklyn, N.Y. 1947. 307 pp., diagrs., charts, tables, 8¾ x 5½ in., cloth, $7.00.

The principles of powder metallurgy and the relationship between the physical properties of the metallic compact and the variables of the powder metallurgical process are the main issues. Many physical and engineering properties of the powder metallurgical product are shown as functions of the composition, powder particle size, compacting pressure, sintering time and temperature, atmosphere of the heat treatment, subsequent working and other factors of processing. For economy of space detailed descriptive matter is omitted. A glossary of powder metallurgy is given as well as a large bibliography covering the field of powder metallurgy from its beginnings to the present day.

PRINCIPLES OF ELECTRICAL ENGINEERING:

T. F. Wall. Chemical Publishing Co., Remsen Press Division, Brooklyn, N.Y., 1947. 563 pp., illus., diagrs., charts, tables, 8¾ x 5½ in., cloth, $8.50.

Beginning with a brief historical survey of the development of standards for units of measurement, this book continues with a condensed, comprehensive treatment of the following topics: the basic principles and characteristics of both direct and alternating currents; magnetism and magnetic materials; oscillating systems and wave forms; graphical methods of analysis; the propagation of electric energy through lines and cables, and of electromagnetic waves through space. Brief discussions are included on thermo- and piezo-electricity. The book contains no problems. These are to be found in the companion volume, "Electrical engineering problems and their solutions".

STEAM GENERATION:

J. N. Williams. Evans Bros., Ltd., Montague House, Russell Square, London, England, 1946. 372 pp., illus., diagrs., charts, tables, 8½ x 5¼ in., cloth, 25 s.

Beginning with the theory and basic practice of combustion, this practical work covers the subject of boiler management in a comprehensive manner. Basic and auxiliary equipment is described; boiler operation is dealt with; oil fuel, coal, pulverized fuel, coke and breeze are covered; and feedwater treatment is discussed. Separate chapters are devoted to heat transmission, automatic boiler control, and flue gas cleaning.

SURFACE CONSTRUCTION WITHOUT ACCIDENTS:

American Mutual Liability Insurance Company, Engineering Department, 142 Berkeley St., Boston 16, Mass., 1946. 81 pp., illus., tables, 7½ x 5 in., fabrikoid, apply.

The term, surface construction, is used to mean streets, runways, parking areas, airports, and similar projects where earth-moving, paving, and related operations are principally involved. The major part of the book is devoted to specific safety instructions for the various types of jobs included in such work. Separate chapters deal with the protection of the general public, first aid, and payroll and cost records.

TABLES NUMERIQUES UNIVERSELLES DES LABORATOIRES ET BUREAUX D'ETUDE:

M. Boll. Dunod, Paris, 1947. 881 pp., diagrs., charts, tables, 11 x 7 in., stiff cardboard, 3,200 frs.

This comprehensive work presents for the use of the laboratory or research worker a collection of more than 200 useful tables covering arithmetical and algebraic operations, trigonometric expressions, exponentials, probabilities, complex numbers, constants, and conversion tables of units. The material varies from simple, general, numerical expressions to special calculations, and in more than half of the cases a graphical illustration is provided by a diagram. Interpolation methods are described, and a detailed subject index is included. Terms are carried out to 8 or 10 places, although 5 to 6 places or less are more generally supplied, depending on the character of the items in question.

TREATISE ON MILLING AND MILLING MACHINES, 3 ed. Section I:

Cincinnati Milling Machine Co., Cincinnati, 9, Ohio, October, 1945. 182 pp., illus., diagrs., charts, tables, 9 x 6 in., stiff paper, $1.00.

This publication presents a general description of the function and operations of milling machines and their accessories as well as the cutting tools used in these operations. Typical milling examples of actual installations are given to demonstrate proper work handling. The chapters on materials for and types of milling cutters are based on company research. Some forty pages are devoted to the sharpening and care of cutters.

WRITING THE TECHNICAL REPORT:

J. R. Nelson. 2 ed. McGraw-Hill Book Co., New York and London, 1947. 388 pp., diagrs., tables, 9 x 5½ in., cloth, $3.00.

The first part of the book presents a review of those fundamental considerations which bear on the design and composition of the report. The second gives specific directions for the setup of the report, with several illustrative reports of both the long and short form. The third outlines a systematic procedure for the critical examination of a report, and the last part suggests a series of assignments for those who wish to use the book as a classroom text. Although little changed essentially from the earlier edition, the book now contains an index.

Although not available in the Institute Library, inquiries concerning the following new books will be welcomed there or may be sent direct to the publishers.

AIRCRAFT CARBURETION:

R. H. Thorner. John Wiley & Sons, New York, Chapman & Hall, London, 1946. 393 pp., illus., diagrs., charts, tables, 8½ x 5½ in., cloth, $3.50.

Intended for both the practical man in any phase of the aviation field as well as for the student, the book first presents the fundamental principles of carburetion and then uses modern aircraft carburetors as examples to prove the basic similarity. There is special emphasis on pressure, pressure measurement, and pressure instruments. The author discusses the principles of operation of the fuel pump and supercharger in relation to the carburetor and engine, and provides a thorough coverage of fuel economy. Concerned primarily with operating principles, no attempt has been made to cover maintenance details.

ASTRONOMY, A TEXTBOOK FOR UNIVERSITY AND COLLEGE STUDENTS:

R. H. Baker. 4th ed. D. Van Nostrand Co., New York, 1946. 461 pp., illus., diagrs., charts, tables, 9¼ x 6 in., cloth, $4.00.

This is a revised edition of a standard textbook for introductory courses in astronomy. It requires no special preparation in mathematics nor physics. The author is Professor of Astronomy in the University of Illinois.

CERAMIC WHITEWARES, HISTORY, TECHNOLOGY AND APPLICATIONS:

R. Newcomb, Jr. Pitman Publishing Corp., New York and Chicago, 1947. 313 pp., illus., diagrs., charts, tables, 9¼ x 6 in., cloth, $5.00.

The production of all types of "ceramic whitewares" (pottery, porcelain and china) is described in detail, including the raw materials, test methods, forming, drying, firing and decorating. The second section covers the properties of the fired ware, and discusses the methods of utilizing these characteristics in a variety of products for use in the home, construction work, the electrical and other industries. Chiefly valuable to the manufacturer and the practical man who is concerned with the engineering properties and uses of ceramics, the book is intended for a wider field and includes a historical introduction showing the development of the art.

CHEMISTRY OF PORTLAND CEMENT:

R. H. Bogue. Reinhold Publishing Corp., New York, 1947. 572 pp., illus., diagrs., charts, tables, 9¼ x 6 in., cloth, $10.00.

This extensive treatise is divided into three main parts: Part I on the chemistry of clinker formation is concerned chiefly with high-temperature reactions in the dry state; Part III on the chemistry of cement utilization deals with reactions between cement and water or solutions; Part II on the phase equilibria of the cement systems provides information on a subject with which both of the other fields of study are intimately concerned. The book also discusses the history and development of the industry, outlines the processes of manufacture, and tabulates X-ray diffraction patterns of components, compounds, and hydration products. Routine chemical and physical methods of test have been omitted since they are readily available elsewhere.

DIESEL OPERATION AND MAINTENANCE:

O. L. Adams, Sr. Prentice-Hall, Inc., New York, 1946. 366 pp., illus., diagrs., charts, tables, 9¼ x 6 in., cloth, $5.00.

Emphasizing the fundamental aspects of Diesel engine operation, this practical book considers in detail the various working parts, including the fuel and lubrication systems, as well as the general working principles. The origin of the major engine problems is identified and traced to these fundamental principles. Standard maintenance, inspection, and repair practices are given, including trouble-shooting instructions for determining causes of engine failures and diagnosing fuel and lubricating problems.

DIFFRACTION OF X-RAYS AND ELECTRONS BY FREE MOLECULES:

M. H. Pirenne. University Press, Cambridge, England; Macmillan Company, New York, 1946. 160 pp., illus., diagrs., tables, 8¾ x 5½ in., cloth, $3.00.

This monograph is intended primarily to give an account of the theoretical basis of the study of X-ray diffraction by gases and of the information it has yielded about the structure of atoms and molecules. Consideration is also given to the diffraction of fast electrons by gases, the scattering of X-rays by atoms in crystals, and the diffraction of X-rays by liquids. Fundamental ideas and experimental results are emphasized. A complete bibliography has been attempted of the original literature on X-ray diffraction by gases with some significant references on diffraction by liquids.

ELEMENTS OF HYDRAULIC ENGINEERING:

D. S. Ellis. D. Van Nostrand Company, New York, 1947. 277 pp., diagrs., charts, tables, 9¼ x 6 in., cloth, $3.50.

Chapters I to X present a concise treatment of the basic ideas and methods of hydraulics, from hydrostatics to the dynamic effects of fluids, customary for a first course in the subject. The remainder of the book is concerned with the operating characteristics of the commoner hydraulic machines such as pumps, water wheels and fans, and with such special topics as water hammer, waves and surges in open channels. The author uses these topics, as examples of hydraulic application, in combination with the theory to form a one-year course for mining, metallurgical, and chemical engineering students.

REVIEW OF METAL LITERATURE, VOL. 2, 1945:

Prepared for the Members of the American Society for Metals by Battelle Memorial Institute, Columbus, Ohio, published by American Society for Metals, Cleveland 3, Ohio, 1946. 213 pp., 9¼ x 6 in., cloth, $15.00.

This annotated survey lists articles and technical papers appearing in engineering, scientific and industrial journals, both here and abroad. The present volume is a collection of the installments from February, 1945 through January, 1946 of the "Review of Current Metal Literature" which appears in "The Metals Review", and covers the metallurgical literature of 1945. The annotations are classified in sections primarily by processes: smelting and refining, powder metallurgy, electroplating, heat treatment, etc. There are also a detailed subject index, an author index, addresses of magazines covered, and an annotated list of technical books published within the period covered.

RARER METALS:

J. De Mont and H. C. Dake with foreword by C. G. Fink. Chemical Publishing Co., Brooklyn, New York, 1946. 392 pp., illus., diagrs., charts, tables, 8¾ x 5½ in., cloth, $7.50.

This reference work provides basic data on the history, mineralogy, physical and chemical properties, compounds, extraction and preparation, technology, and analysis of some twenty metallic elements. They range in obscurity from the commonly recognized platinum and uranium down to such veritable strangers as hafnium and osnium, excluding the metals of the rare earths. Dealt with in periodic table groups according to their similarities, each chapter has its own list of references. A sixteen page bibliography of the rarer elements mainly within the period 1935-1940 is appended.

STEAM POWER STATIONS:

G. A. Gaffert. 3 ed. McGraw-Hill Book Co., New York and London, Toronto 1946. 613 pp., illus., diagrs., charts, tables, 9 x 6 in., cloth, $5.50.

Steam power plant machinery is covered from the standpoint of construction of the various types of equipment, their performance characteristics, economics, and integration in the complete plant. The new edition of this standard textbook has been revised, and includes recent information on modern equipment, such as steam turbines, condensing equipment, steam-generating units, and mercury-steam installations. The material has been strictly confined to the mechanical-engineering features, with emphasis on design and construction.

TRANSPORTATION PRINCIPLES AND PROBLEMS:

T. C. Bigham. McGraw-Hill Book Co., New York and London, Toronto, 1946. 626 pp., diagrs., charts, maps, tables, 9¼ x 6 in., cloth, $5.00.

Designed for college courses in transportation, this textbook covers railroads, motor carriers, pipe lines, airways, and inland coastwise and intercoastal waterways. These forms of transportation are treated jointly from a functional point of view, with the primary purpose of promoting the establishment of more rational transportation policies. A historical and factual background is presented in the early chapters, followed by material on state and federal transport legislation. Over 200 pages are devoted to the various aspects of the important problem of rate setting. The last seven chapters take up service, security issuance, combination of carriers, labor, public aid, government ownership, and general improvement of public policy. Extensive footnotes and references are provided.

CANADA'S NORTH MAGNETIC POLE

(Continued from page 457)

being provided vital plane transportation by the Royal Canadian Air Force, and the co-operation of other organizations, in establishing at least fifteen magnetic stations spaced strategically around Somerset Island. In addition, a temporary magnetic observatory will be established at Baker Lake, N.W.T., to supplement the Meanook magnetic observatory in furnishing control to field observations for daily variations and disturbances.

It is hoped the magnetic survey of Canada can be continued northward until the entire Canadian Arctic is covered by a network of magnetic stations, with the required number of magnetic observatories necessary for control. Then the movements of the north magnetic pole will be under continuous scrutiny so that reasons for its motion may be deduced and its position for any epoch removed from the realm of conjecture to that of certainty.

RECENT TESTS IN INDUCTIVE CO-ORDINATION OF RURAL ELECTRIFICATION AND TELEPHONE LINES

(Continued from page 482)

used. The noise-to-ground, when measured with the proper terminations, is a fair measure of the severity of the exposure.

GROUND-RETURN IT PRODUCT

This is the product of the ground-return current in amperes by its own TIF. The easiest way to measure it is usually by means of a probe wire, as shown in Fig. 8. The method is described fully in the Engineering Reports of the Joint Subcommittee on Development and Research, Edison Electric Institute and Bell Telephone System, Vol. III, pages 134 to 137.

PRELIMINARY NOTICE

of Applications for Admission and for Transfer

September 30th, 1947

The By-laws provide that the Council of the Institute shall approve, classify and elect candidates to membership and transfer from one grade of membership to a higher.

It is also provided that there shall be issued to all corporate members a list of the new applicants for admission and for transfer, containing a concise statement of the record of each applicant and the names of his references.

In order that the Council may determine justly the eligibility of each candidate, every member is asked to read carefully the list submitted herewith and to report promptly to the Secretary any facts which may affect the classification and selection of any of the candidates. In cases where the professional career of an applicant is known to any member, such member is specially invited to make a definite recommendation as to the proper classification of the candidate.*

If to your knowledge facts exist which are derogatory to the personal reputation of any applicant, they should be promptly communicated.

Communications relating to applicants are considered by the Council as strictly confidential.

The Council will consider the applications herein described at the November meeting.

L. Austin Wright, General Secretary

*The professional requirements are as follows:—

A **Member** shall have been engaged in some branch of engineering for at least six years, which period may include apprenticeship or pupilage in a qualified engineer's office or a term of instruction in a school of engineering recognized by the council. In every case a candidate for election shall have held a position of professionl responsibility for at least two years. The occupancy of a chair as professor, assistant professor, associate professor or lecturer in a faculty of applied science or engineering, shall be considered as professional responsibility.

Every candidate who has not graduated from a school of engineering recognized by the council shall be required to pass an examination as prescribed by council, on the theory and practice of engineering, with special reference to the branch of engineering in which he has been engaged.

A **Junior** shall have been engaged in some branch of engineering for at least four years. This period may be reduced to one year, if the candidate for election has graduated from a school of engineering recognized by the council, in which case he shall not remain in the class of Junior beyond the end of the eighth year after graduation.

Every candidate who has not passed the examinations of the third year in a school of engineering recognized by council shall be required to pass an examination in engineering science as prescribed by council. He shall not remain in the class of Junior beyond age thirty.

A Junior may be transferred to Member without payment of transfer fee providing he makes application before the end of the seventh year after graduation or, if a non-graduate, before attaining age twenty-nine, and his application is approved by council.

Council may extend the above limits if in its opinion special circumstances warrant such extension.

A **Student** shall be at least seventeen years of age, and shall present a certificate of having passed an examination equivalent to the final examination of a high school, or the matriculation of an arts or science course in a school of engineering recognized by the council or shall be required to write examinations as prescribed by the council.

He shall be:

a. pursuing a course of instruction in a school of engineering recognized by the council, in which case he shall be transferred to Junior automatically without payment of transfer fee in the second January after graduation, or

b. receiving a practical training in the profession in which case he shall be transferred to Junior without payment of transfer fee providing he makes application before attaining age twenty-five and his application is approved by council.

He shall not remain in the class of Student after he has attained the age of twenty-five, unless in the opinion of council special circumstances warrant the extension of this age limit.

An **Affiliate** shall be one who is not an engineer by profession but whose pursuits, scientific attainments or practial experience qualify him to cooperate with engineers in the advancement of professional knowledge.

The fact that candidates give the names of certain members as reference does not necessarily mean that their applications are endorsed by such members.

FOR ADMISSION

GWYTHER—VAL M. W., of Port Alberni, B.C. Born at Bedford, England, Feb. 14, 1900. Educ.: B.A.Sc., (Civil), British Columbia, 1924; R.P.E., British Columbia; 1924, inspectr., dam and dock constrn., Powell River Co.; 1925-26, res. engre., pipe line constrn., Seymour Creek, City of Vancouver; 1926, supt. constrn., Vancouver Pile Driving Co.; 1927, instru'man., B.C. Electric Rly. Co.; 1928, chief inspectr., Alberta Wheat Pool elevator, C. D. Howe & Co.; 1928-29, res. engr., Fraser River elevator, W. G. Swan; 1929-31, for Stuart Cameron & Co., Ltd., engr. i/c extension, Olympic Portland Cement Co., Bellingham, Wash.; extension, Powell River Co. plant; 1932, locating engr., Provincial Gov't.; 1933-35, mine surveyor & outside engr., Pioneer Mines & B.C. Nickel Mines; 1936, designing & constrn. engr., extension to plant St. Lawrence Paper Mills; 1937-38, design & constrn., Bonnington plant, West Kootenay Power & Light Co.; 1939-40, engr. i/c constrn. sulphate pulp mill at Port Alberni, Bloedel, Stewart & Welch Ltd.; 1941-45, R.C.A.F., Constrn. Branch; 1945 to date, res. engr. i/c constrn., kraft mill, Port Alberni, Bloedel, Stewart & Welch Ltd.

References: E. A. Cleveland, W. G. Swan, A. S. Mansbridge, W. H. Powell, P. B. Stroyan.

HARRINGTON—JOHN ERIC, of Montreal, Que. Born at Montreal, Que., Aug. 28, 1914. Educ.: Graduate, Royal Military College, 1937; with Anglin-Norcross Corp. Ltd., Montreal, as follows: 1937-38, estimating dept. and office work, 1938-39, field engrg. (Supreme Court bldg., Ottawa); 1939-45, Lieut. Cmdr., H.M. Navy; 1945 to date, field and office work, Anglin-Norcross Corp. Ltd., Montreal, (vice-pres. of the company).

References: E. P. Fetherstonhaugh, P. N. Gross, L. A. Wright, C. D. Woolward, E. H. Manley, R. W. Johnston.

JONES—STUART GRANT, of Windsor, Ont. Born at Smith Falls, Ont., Dec. 17, 1919. Educ.: B.Sc., (Chem. Engrg.), Queen's, 1941; 1941, lab. chemist, Welland Chemical Works; 1941-46, R.C.E.M.E., Adjt. 2 i/c Workshops, (overseas, 1943-46); 1946 to date, industrial sales engr., Imperial Oil Limited, Windsor, Ont.

References: D. S. Ellis, A. O. Monk, G. A. Cunningham, J. Breakey, J. F. Blowey, J. G. Turnbull.

LANG—EDWIN GEORGE POWER, of Thessalon, Ont. Born at Wimbledon, Eng., March 5, 1896. Educ.: R.M.C., Sandhurst, Eng.; Croydon Poly., London, Eng.; R.P.E., Quebec, (by exam.); 1924-25, instru'man., Canadian National Rlys.; 1925-26, instru'man., Shawinigan Engineering Co., Montreal; 1926-34, field engr., Canadian Car & Foundry Co., Montreal; 1935-36, private geological investigations; 1937-39, geo. investigator, concrete aggregate, Northern Ontario, Canada Cement Co., Montreal and Toronto; 1940-41, sr. asst. engr., Dept. National Defence, Montreal; 1941-45, Works Officer, F/L, Dept. National Defence for Air, Montreal and Moncton; 1945-47, constrn. engr., Canadian Pacific Rly. Co., Montreal, Que.; at present, res. engr., tunnel devel'pt., Mississaugi River, H.E.P.C. of Ontario, Thessalon, Ont.

References: E. M. MacQuarrie, J. M. Breen, J. A. McCrory, W. McG. Gardner, M. Boyer, C. C. Lindsay, J. B. Stirling.

LITTLE—HENRY WALSINGHAM, of Renfrew, Ont. Born at Teeswater, Ont., Sept. 4, 1907. Educ.: B.Sc., (Elect.), Queen's, 1932; R.P.E., Ontario; 1932-34, student apprent., A. Reyrolle & Co., Hebburn, Eng.; 1934-35, mtce. elect., Anaconda American Brass, Toronto, Ont.; 1936-42, sales engr., Northern Electric Co.; 1943-45, Elect. Lieut., R.C.N.V.R.; 1945-46, sales engr., Northern Electric Co., Montreal, Que.; at present, manager and sect.-treas., Hydro Electric Commission of the Town of Renfrew, Ont.

References: P. J. Croft, W. R. Bunting, J. G. McLellan, C. C. Simpson.

MACLEAN—AROS LOUDON, Major, R.C.E.M.E., of London, Ont. Born at Toronto, Ont., Jan. 29, 1918. Educ.: B.A.Sc., Toronto, 1941; R.P.E., Ontario; with R.C.E.M.E., as follows: 1941-42, Lieut., (OME) R.C.O.C., 1942-44, Workshop Officer with 1 Canadian Base Workshop, U.K., with rank of Capt., 1944-45, Tire Repair Unit, North West Unit, 1945-46, Second in Command 1 Canadian Sub Workshop, U.K., with rank of Major, 1946 to date, O/C R.C.E.M.E. Workshop, Officer I/C Base Workshop, 27 C.O.D., London, Ontario.

References: W. J. T. Wright, J. R. Cockburn, H. G. Ambrose, C. G. Williams.

MILNE—HENRY ALEXANDER, of Vancouver, B.C. Born at Glasgow, Scotland, April 9, 1906. Educ.: B.Sc., (Civil), Saskatchewan 1933; R.P.E., British Columbia; 1938-39, waterman, i/c heating in three Prairie provinces, Waterbury Mfg. Co., Regina, Sask.; 1939-40, chief instructor, Dominion Prov. Youth Training programme, Regina Centre; 1940-45, various administrative engrg. positions in R.C.A.F., later as sr. organization Officer in Canadian Bomber Group in Britain, supervising constrn. with rank of Squadron Leader; asst design engr., constrn. dept., Sorg Pulp Co., Vancouver, B.C.

References: W. N. Papove, H. M. Lewis, J. G. D'Aoust, G. W. Allan.

MORDELL—DONALD LOUIS, of Montreal, Que. Born at London, England, Dec. 9, 1920. Educ.: B.A., 1942; M.A., 1946, (Mechanical Sciences Tripos), St. John's College, Cambridge; A.M., Inst. Mech. Engineers, London, Assoc. Fellow, Royal Aeronautical Society; 1938-39, apprent., Metropolitan Vickers Ltd., Manchester; with Rolls Royce Limited, as follows: 1941-42, pupil, 1942-43, mech. assist., export dept. labs., 1943-45, sr. mech. assist., export dept., 1945-47, engineer i/c combustion, research and development; at present associate professor, Mechanical Engineering Dept., McGill University, Montreal, Que.

References: C. A. Robb, R. DeL. French, J. J. O'Neill, C. M. McKergow, R. E. Jamieson.

OVERALL—CYRIL, of Niagara Falls, Ont. Born at Walthamstow, England, May 7, 1905. Educ.: B.Sc., (Chem. Engrg.), Tri-State College of Engrg., 1932, (not accredited E.C.P.D.); R.P.E., Ontario (without exam.); 1923-25, North American Cyanamid Ltd.; 1925-27, Kimberly-Clark, New York; 1927-30, Spruce Falls Power & Paper Corp., Kapuskasing, Ont.; 1932-33, design engr., North American Cyanamid Ltd.; 1933-34, Ontario Coll. for Technical Teachers, Hamilton; 1934-36, design engr., North American Cyanamid; 1936-37, dftng. instructor, maths., welding, Niagara Falls Collegiate & Vocational Institute, 1937-38, design dftsman. & engr., H. G. Acres & Co., Ltd., Niagara Falls, Ont.; 1938-40, design dftsman. & engr., Sawyer Massey Ltd., Hamilton, Ont.; 1945 to date, chief dftsman., Carborundum Co., Niagara Falls, N.Y.

References: C. W. Boast, S. W. Andrews, C. Climo, H. L. Bucke, A. W. F. McQueen, G. E. Griffiths.

PATTERSON—JAMES LESLIE, of Weston, Ont. Born at Kingston, Ont., Nov. 25, 1907. Educ.: Elect. Lighting, I.C.S., 1924-27; British Institute of Engrg. Tech., (corr. school) (A.M.I. Mech. Engrs. course, 1936-40); Central Tech. School, Toronto, 1938-39, (structl. steel & concrete design); R.P.E., Ontario, (without exam.); with Aluminum Co. of Canada, as follows: 1927-28, cable mill, 1928-30, sheet metal layout & machine shop, 1930-32, dftng. room detail & design, (Aluminum Co. of America, Massena, N.Y.); 1932-35, sheet foil & seal mills, Toronto; 1935-41, design of press tools, jigs, fixtures, mould dies, die casting dies, (devel'pt. & design of same), estimating & work schedules, etc., Montreal; 1941, (3½ mos.), engrg. dept., special work on expansion of bauxite ore plant No. 1, design and layout of new equipt., worked with chief engr. on design & layout of new No. 2 ore plant, Arvida; 1941 (2 weeks), design of equipt. for lab. and forging hammers, plant layout, Kingston, Ont.; 1941-44, works engr., i/c millwrights, electricians, power engrs., etc., plant expansion, new bldg. programs, plant layouts, etc., Canada Cycle & Motor Co., Ltd., Weston, Ont.; 1944 to date, genl. plant supt., i/c mfg., lab. control, etc., A. P. Green Fire Brick Co., Ltd., Weston, Ont.

References: J. H. Ross, R. F. Legget, G. B. Moxon, E. B. Horton.

ROONEY—SIDNEY CRAWFORD, of Vancouver, B.C. Born at Winnipeg, Man., Oct. 15, 1913. Educ.: B.A.Sc., (Mech.), British Columbia, 1942; R.P.E., British Columbia; with B.C. Pulp & Paper Co., Ltd., as follows: 1936-37, (summer), tech. control, 1938, (summer), jr. dftsman., 1939-41, (summers), jr. engr., 1941, (summer), design of hog fuel handling system; 1942-44, asst. chief design dftsman., machine design, plant design, equipt., layout and bldg., Aluminum Co. of Canada; 1944-45, design engr., paper machinery design, Waterous Ltd., Brantford, Ont.; 1945-46, design engr., design of screen and washer bldg., with layout of equipt. etc., Bloedel, Stewart & Welch; 1946 to date, chief engr. and genl. mgr., pulp, paper and sawmill design, Columbia Mill Development Co., Ltd., Vancouver, B.C.

References: G. W. Allan, W. R. Bonnycastle, J. N. Finlayson, W. A. Bain, A. C. R. Yuill.

ROSS—WILLIAM EDWARD, of St. John's N'fld. Born at Edmonton, Alta., Jan. 16, 1908. 1937-42, dist. supt., Calgary Power Co., Ltd., Lethbridge, Alta.; 1942-46, operating supt., Prairie Power Co., Ltd., Regina, Sask.; at present, gen'l. supt., N'fld. Light & Power Co., Ltd., St. John's, Newfoundland.

References: G. A. Gaherty, G. H. Thompson, H. B. Sherman, H. Randle, H. B. LeBourveau, T. D. Stanley, J. T. Watson.

SHAW—CHARLES GORDON, of Vancouver, B.C. Born at Southampton, Ont., Dec. 30, 1908. Educ.: Writing intermediate exam. (mech.), Assn. Prof. Engrs. of British Columbia; 1927-30, rodman, C.N.R., survey party at Edmonton; 1941-42, dftsman., Boyles Diamond Drilling Co., 1939 to date, chief dftsman., Canadian White Pine and MacMillan Industries Limited, Vancouver, B.C. (Asks for Affiliate).

References: G. W. Allan, G. H. Bancroft, P. N. Bland, A. Pearson, D. J. Rattenbury.

SUMNER—JOSHUA, of East Kildonan, Man. Born at Liverpool, England, Jan. 28, 1906. Educ.: B.Sc., (Civil), Manitoba, 1926; R.P.E., Manitoba; 1923 and 1935, (summers), chainman and rodman, Canadian Pacific Railway Co.; 1926-33, strucl. designing engr., Truscon Steel Co. of Canada, Winnipeg and Regina; 1936-37, structl. designing engr., C. D. Howe Co., Port Arthur, Ont.; 1937-40, structl. designer, Truscon Steel Co. of Canada, Walkerville, Ont.; 1944-45, R.C.A.F., as Works Officer, Charlottetown, P.E.I.; Works Officer No. 1 Air Command, North West Air Command; 1946 to date, structl. designer, i/c structl. engrg. design, Green, Blankstein, Russell, architects and engrs., Winnipeg, Man.

References: C. V. Antenbring, E. A. Ford, J. C. Trueman, W. D. Hurst, J. B. Striowski.

TABERNOR—WILLIAM ERNEST, of Winnipeg, Man. Born at Stafford, England, April 14, 1910. Educ.: County Technical Coll., Stafford, Eng., 1934-40; holder of Higher National Certificate in Elect. Engrg., 1940; with English Electric Co., as follows: 1934-40, switchgear design, Stafford, 1940-42, prod. engrg. for switchgear design and develop't., 1942-45, circuit engr., 1945-46, tech. sales engr., plant sales, 1946-47, tech. sales engr., Cardiff, Wales; at present, engr., elect. design, City of Winnipeg Hydro Electric System, Winnipeg, Man.

References: H. L. Briggs, R. T. Harland, D. C. Bryden, R. A. Stewart, T. E. Storey.

TAYLOR—GEORGE, Ordnance/Commander, R.C.N., of Ottawa, Ont. Born at Shipley, Yorks, Eng., June 14, 1900. Educ.: Manchester Univ., 1922-24, special two years course in mech. and civil engrg. to B.Sc. standard, (owing to war conditions did not matriculate, hence degree not granted by univ.); A.M. Inst. Mech. Engineers, London; with Vickers Ltd., Barrow, Eng., as follows: 1919-24, five yr. apprent., fitter and turner, 1924, improver, dftsman., 1925, asst. to genl. shop mgr.; 1926-27, asst. engr., Gold Coast Gov't. Rlys. constrn, mech. and civil survey work, i/c engrg. shops; 1928-30, dist. engr., Sudan Gov't. Rlys. and Steamers, rly. constrn., surveys, harbour engrg., etc.; 1930-36, 3 yrs. as mech. dftsman., with promotion to section leader, Vickers Armstrong Ltd., Barrow, 3 yrs. as asst. shop mgr., same firm; 1936-40, shop mgr., Harland & Wolff Ltd., Glasgow (Scotstown Ordnance Works); with R.N.V.R., as follows: 1940-41, Lieut. (E), British Admiralty Technical Mission staff, 1941-44, Lieut. Cmdr. (E), B.A.T.M. staff, 1944-46, Cmdr. (E), B.A.T.M., staff; and at present, Ordnance/Commander, R.C.N. as Chief Inspector of Naval Ordance, Directorate of Naval Ordance, Dept. National Defence, Ottawa, Ont.

References: J. G. Notman, H. B. Bowen, W. Casey, J., O Halloran, B. R. Spencer.

WALKER—WILLIAM MACFARLANE, of Vancouver, B.C. Born at Vancouver, B.C., July 14, 1920. Educ.: B.A.Sc., (Elect.), British Columbia, 1945; 1941-44, (summers), constrn. work, B.C. Packers Ltd.; dftng. and grading, Canadian Wood Pipe & Tank; lab. technician, B.C. Sugar; 1945, (7 mos.), R.C.N.V.R.; 1946 to date, industrial power engr., industrial power dept., British Columbia Electric Railway, Vancouver, B.C.

References: G. W. Allan, W. N. Kelly, J. N. Finlayson, A. Peebles, H. J. MacLeod.

FOR TRANSFER FROM JUNIOR

ARCHIBALD—HUESTIS EVERETT, of Kirkland Lake, Ont. Born at St. Stephen, N.B. on Oct. 8, 1920. Educ.: B.A.Sc. (Civil) Toronto, 1943; R.P.E. Ontario. 1943-45, Royal Canadian Engineers (Lieut.), at one time second-in-command of Motor Transport Company, Petawawa; 1945 (Jan. to Sept.) asst. engr., Ontario Dept. of Planning and Development, Municipal Branch; 1945-46, asst. engr. James Proctor & Redfern Ltd. consulting engrs. Toronto; 1946 to date, township engr., Township of Teck. Kirkland Lake, Ont. (St. 1942. Jr. 1945).

References: A. E. K. Bunnell, W. B. Redfern, S. H. deJong, H. E. Bushlen, D. O. D. Ramsdale.

ASKWITH—FRANCIS LLOYD GEORGE, of Ottawa, Ont. Born at Ottawa on April 16, 1917. Educ.: B.Sc. (Elect.) Queen's 1940; R.P.E. Ontario; 1940-43, R.C.N.V.R. Officer i/c Radar Mtce. base, responsible for all radar ship fitting and mtce.; 1944-45, Staff Radar Officer, Can. Naval Mission o'seas, London, England, Nov. 1945-April 1946, technical officer, Research and Development Br. Dept. Reconstruction & Supply; 1946-47 (Mar.) elect. engr. Dept. of National Defence (Naval Service); at present, distribution dept., Gatineau Power Co. Ottawa. (St. 1938. Jr. 1946).

References: D. M. Jemmett, D. S. Ellis, J. L. Gray, E. G. Cullwick, Alan Brown, J. N. Stinson.

BALES—ROBERT PHILLIP, of Hamilton, Ont. Born at Toronto on March 29, 1915. Educ.: B.A.Sc. (Chem.) Toronto, 1938. 1938-42, rubber technology, Dominion Rubber Co., Montreal; 1942-45, R.C.A.F. Aeronautical Engr. and chief technical officer at Bomber Station, England; 1945-47, technical supt. Dominion Rubber Co. St. Jerome; 1947 to June, sales eng. Waterous Ltd., Brantford; at present production supt., Building Products Ltd., Hamilton. (Jr. 1940).

References: L. J. Newton, C. A. Miller, R. Ford, A. Benoit.

BEECHER—KEITH DAVIDSON, of Montreal, Que. Born at Montreal, Que., Dec. 6, 1917. Educ.: B.Eng. (Elect.), McGill, 1941; 1939 and 1940, (summers), student, Aluminum Co. of Canada; Noranda Mines Ltd.; 1941-42, R.C.N.V.R., with rank of S/L (E) and Lieut. (E); 1944. asst. shop engr., Montreal Locomotive Works; 1945-47, assoc. patent examiner, Canadian Patent Office; and at present patent dept., General Electric Co., Schenectady, N.Y. (Jr. 1946).

References: A. E. MacRae, R. O. McGee, F. Dugal, C. A. Norris, L. A. Wright, C. V. Christie.

BOULTBEE—JAMES GREER, of Toronto, Ont. Born at Toronto, Ont., Jan. 6, 1920. Educ.: B.A.Sc., (Civil), 1941; B.Sc., (Forestry), 1947, Toronto; R.P.E., Ontario; 1941-43, material control supvr., Federal Aircraft Ltd.; 1943-45, Lieut., R.C.E.; with Longlac Pulp & Paper Co., Ltd., as follows: 1946, townsite engr., 1947 to date, constrn. engr., Longlac, Ont. (Jr. 1943).

References: W. Thornber, C. F. Morrison, C. R. Young, R. F. Legget, O. K. Smith.

BROWN—MALCOLM CORSAN SUTHERLAND, Lt. Col., R.C.E., of Ottawa, Ont. Born at London, England, Nov. 14, 1917. Educ.: Graduate, R.M.C., 1938; B.Sc., (Civil), Queen's, 1939; with R.C.E., as follows: 1938-39, genl. constrn. as Works Officer, Kingston, 1939, Asst. District Engr. Officer, Calgary, Alta., 1939-45, military engrg. overseas in various Engineer Units, in ranks from Lieut. to Lieut. Colonel, 1945-47, general constrn., as District Engr. Officer; and at present, D.V.A., Assistant Director of Works and Accommodation, Army H.Q., Ottawa, Ont. (St. 1937. Jr. 1946).

Refereces: G. R. Turner, J. L. Melville, A. W. Haddow, G. P. Stirret, W. Scales, N. E. Rodger.

CHERRY—HAROLD JOHN, of North Bay, Ont. Born at North Bay, Ont., July 6, 1920. Educ.: B.A.Sc., (Civil), Toronto 1944; R.P.E., Ontario; 1941 and 1942, (summers), airport constrn., Dept. of Transport, as rodman and instru'man.; 1944-45, design and constrn. of timber bridges, R.C.E.; 1945-47, constrn. of reinf. concrete gauging stations, Dept. of Mines & Resources, British Columbia; at present, instru'man., Canadian National Railways, North Bay, Ont. (St. 1944. Jr. 1946).

References: R. F. Legget, C. E. Webb, H. H. Minshall, W. H. B. Bevan C. F. Morrison, S. H. deJong.

CUNNINGHAM—ROBERT AULD, of Campbell River, B.C. Born at Greenock, Scotland on Jan. 24, 1918. Educ.: B.Sc. (Civil), Queen's 1941; 1941-42, Jr. engr. Price Bros. & Co., Kenogami, Que., surveys, dftg., general engrg. on mill mtce.; 1942-44, field engr. E.G.M. Cape & Co. constrn. in N'fld.; April 1944-July 1944, instru'man, C.P.R. Trenton Div.; Aug. 1944-July 1945, asst. to res. engr., Sorg Pulp Co., Port Mellon, B.C.; 1945-46, field eng. Armstrong & Monteith Const. Co., Vancouver, B.C.; at present field engr. H. G. Acres & Co., Niagara Falls, Ont., employed on the Campbell River Hydro Development Proj. i/c power house contrn. for res. engr. (St. 1941. Jr. 1945).

References: T. M. MacIntyre, H. Serson, J. B. Stirling, M. L. Gale, G. F. Layne, P. C. Kirkpatrick.

DAVIDSON—GEORGE ROSS, of Victoria, B.C. Born at Pincher Creek, Alta., March 2, 1913. Educ.: Graduate, R.M.C., 1935; 1929-31, stakeman, rodman, chainman, Canadian Pacific Railway; with R.C.A.S.C., as follows: 1935-36, Supply Officer, 1937-39, Transport Officer, 1940, D.D.S.& T.O., 1941, Staff Captain, 1942, Brigade Supply Officer, 1943, G.S.O. III, 1943-46, G.S.O. II., with the rank of Lieut. and finally Major. (St. 1934. Jr. 1942).

References: R. H. Self, G. Griffiths, C. Mayhew, L. F. Grant, H. H. Lawson, C. H. Skelton.

DRURY—CHIPMAN H., of Montreal, Que. Born at Montreal on July 15, 1917. Educ.: Royal Military College, 1938, B. Eng. (Chem.) McGill Univ. 1939; R.P.E. Quebec; 1939, executive engr. asst., Canadian Car & Foundry, Mexico; 1939-45, (Colonel) Cdn. Army in Canada, England, N. Africa, Italy, N.W. Europe; 1946 attending Harvard for Master Business Administration: at present Junior executive, Canadian Car & Foundry Ltd. (St. 1937. Jr. 1946).

References: L. F. Grant, S. Kidd, R. Chadwick, H. H. Lawson.

HAMILTON—HARRY IRWIN, of Sao Paulo, Brazil, S.A. Born at Toronto, Ont., May 1, 1918. Educ.: B.Sc., (Mech.), Queen's, 1947; R.P.E., Ontario; 1938-9-40, (summers), routine analysis at lab., plate shops, tool and die room, Algoma Steel Corp.; 1941, expeditor, special products divn., R.C.A. Victor, Montreal; 1941-42, instructor, R.C.A.F. technicians' course at Queen's; 1943-46, mech. engr., Demerara Bauxite Co., British Guiana; 1946 to date, i/c mechanical and elect. dept. of constrn. dept. at Sarra, Sao Paulo Light and Power Co., Sao Paulo, Brazil, S.A. (St. 1941. Jr. 1945).

References: C. Stenbol, T. F. Rahilly, J. C. Batzold, W. K. Cowan, A. Jackson, D. S. Ellis.

FRENCH—JOHN KENNETH, of Montreal, Que. Born at S. Lambert, Que., June 18, 1918. Educ.: B.Eng., (Mech.), McGill, 1940; 1940-42, responsible for procurement of material, preparation of mfg. schedules, preparation of drawings, etc. for mfg. of aircraft hydraulic equipt., B. J. Coughlin Co., Ltd., Montreal; 1945-46, Canadian Army, Deputy Asst. to Director of Mech. Engrg., with rank of Major; 1947 to date, prod. control mgr., responsible for procurement of raw material and preparation of mfg. schedules, Continental Can Co. of Canada, Montreal, Que. (St. 1939. Jr. 1946).

References: O. K. Ross, L. D. McGee, C. M. McKergow, L. A. Wright.

HINK—ANTHONY ALBERT, of Montreal, Que. Born at Transcona, Man., Oct. 11, 1916. Educ.: B.Sc., (Civil), Manitoba, 1943; 1937, (summer), chainman, Shirley King, D.L.S., O.L.S.; 1941, (summer), instru'man., Dept. National Defence; 1942, (summer), insptr., instru'man., Dept. of Transport; with Trans Canada Airlines as follows: 1943-45, jr. engr., 1945-46, surveyor, 1946 to date, sr. airways engr., i/c Trans-Atlantic Airways Engrg. Office, Montreal Airport, Dorval, Que. (St. 1942. Jr. 1946).

References: J. T. Dyment, C. A. Proudfoot, G H. Herriot, A. E. Macdonald E. P. Fetherstonhaugh, W. F. Riddell.

PAITHOUSKI—NICHOLAS JOSEPH, of Hamilton, Ont. Born at Hamilton, Ont., Oct. 26, 1917. Educ.: B.Sc., (Civil Engrg.), Queen's, 1940; R.P.E., Ontario; 1940-42, asst. field engr. on oil constrn. projects in Sarnia, Calgary and Regina, Imperial Oil Limited; 1942-46, Lieut., R.C.E.; 1946 to date, field constrn. engr., supervising pile driving, concrete work, etc. on cold mills project, Steel Co. of Canada, Hamilton, Ont. (St. 1940. Jr. 1946).

References: D. S. Ellis, J. D. Lee, C. J. Porter, T. B. Doherty, E. W. Henselwood, E. L. Zealand, R. A. Low.

PAPINEAU—MARCEL LEOPOLD, of Noranda, Que. Born at Outremont, Que., Aug. 15, 1911. Educ.: B.A.Sc., C.E., Ecole Poly., 1940; R.P.E., Quebec; 1937-8-9, (summers), and 1940-41, Noranda Mimes Limited; 1941-42, R.C.A.F., No. 6 Repair Depot, Trenton, Ont.; at present asst. to Inspector of Mines, Northwestern Quebec district, Noranda, Que. (St. 1939. Jr. 1942).

References: A. Circe, F. P. Valiquette, J. F. Lecavalier, R. Frigon, L. P. Cousineau, Y, Cousineau, L. A. Wright, L. Trudel.

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Employment Service

The service is operated for the benefit of members of The Engineering Institute of Canada, and for industrial and other organizations employing technically trained men—without charge to either party. It would therefore be particularly appreciated if employers would make the fullest possible use of these facilities to make known their existing or estimated requirements. Notices appearing in the Situations Wanted column will be discontinued after three insertions, and will be re-inserted upon request after a lapse of one month. Personal interviews by appointment.

Situations Vacant

CHEMICAL

CHEMICAL ENGINEER OF CHEMIST required by a Pulp and Paper Mill in Ontario to develop, install and directly supervise the operations of technical control systems for raw material, inspection process control, quality reporting, inventory, measurement and product satisfaction. Salary open. Apply to File No. 3938-V.

CHEMICAL ENGINEER OR CHEMIST required as Technical Superintendent to administer the Technical Department of a Pulp and Paper Mill in Ontario. Mininum of 5 years in technical or production work in the pulp and paper industry. Salary open. Apply to File No. 3938-V.

CHEMICAL ENGINEER required by a Pulp and Paper Mill in Ontario to undertake the solution of manufacturing and technical control problems, etc. Preferably experience in the pulp and paper industry. Salary open. Apply to File No. 3938-V.

ELECTRICAL

ELECTRICAL DRAUGHTSMAN required in Newfoundland for general industrial power installation. Salary $350 and board. Apply to File No. 3941-V.

ELECTRICAL ENGINEER wanted for new Chemical Plant in Western Ontario. Engineer must have had previous Electrical Rectification experience. Salary open. Apply to File No. 3945-V.

MECHANICAL

MECHANICAL DRAUGHTSMAN required in Newfoundland, must have enough experience to do piping and equipment layout work. Salary $350 and board. Apply to File No. 3941-V.

MECHANICAL ENGINEER with construction experience or Civil Engineer with some mechanical background, required in Montreal for maintenance of construction plant and machinery. Salary open. Apply to File No. 3943-V.

MINING

MINING ENGINEER with several years experience required by a company engaged in large scale asbestos production in Quebec. Salary open. Apply to File No. 3935-V.

MISCELLANEOUS

CITY ENGINEER required by City of Moose Jaw, Saskatchewan. Salary open. Apply to File No. 3856-V.

DETAILERS OR JUNIOR DESIGNERS on mechanical or sheet metal design required by an industrial organization in Ontario. Salary open. Apply to File No. 3904-V.

RECENT GRADUATE required by a Montreal contractor for survey and making of plans. Must be bilingual. Salary $175 up according to experience. Apply to File No. 3933-V.

TOWNSITE ENGINEER OR MANAGER required by an Ontario Pulp and Paper Mill. Townsite part under construction. Salary open. Apply to File No. 3936-V.

RECENT GRADUATE willing to learn and study in detail the welding industry, required by an industrial organization in Montreal. Salary open. Apply to File No. 3937-V.

MECHANICAL OR CHEMICAL ENGINEER required by a Pulp and Paper Mill in Ontario to secure continuous optimum performance from all process instruments, maintenance of instruments, etc. Salary open. Apply to File No. 3938-V.

SALES ENGINEER required for the Toronto office of a large industrial firm. Preferably with mechanical background. Excellent future for suitable candidate. Must be resident of Toronto. Salary open. Apply to File No. 3939-V.

TWO METALLURGICAL ENGINEERS AND ONE CHEMICAL ENGINEER required by large industrial firm in the Maritimes. Good opportunity for advancement in Research, Development and Production. Salary open. Apply to File No. 3942-V.

SENIOR DRAUGHTSMAN, preferably with pulp and paper experience, required by a paper manufacturer for work in Montreal. Must have general engineering knowledge. Salary open. Apply to File No. 3944-V.

SALES ENGINEER, recent graduate, mechanical background, required by a Montreal firm manufacturing steel tanks, oil drums, and other equipment for the oil industry. Salary up to $225. Bilingual an advantage. Apply to File No. 3946-V.

The following advertisements are reprinted from last month's Journal, having not yet been filled.

CHEMICAL

CHEMICAL ENGINEER OR CHEMIST, preferably with Ph.D., required by a pulp and paper company with plants in Eastern Canada, for research work. Salary open. Apply to File No. 3549-V.

CHEMICAL ENGINEER required by a pulp and paper company with plants in Eastern Canada, for mill control and pilot plant work. Salary open. Apply to File No. 3549-V.

CHEMICAL ENGINEER to be assigned to mill process problems for the technical department of a pulp and paper firm in the St. Maurice Valley. Salary $250. up. Apply to File No. 3573-V.

CHEMICAL OR METALLURGICAL ENGINEERS, from recent graduates up, required by a Quebec firm engaged in metal production for employment as production and development engineers. Salaries open. Apply to File No. 3693-V.

CHEMICAL ENGINEER, required by a chemical firm in Shawinigan Falls, Quebec, for development work on plastics. Salary open. Apply to File No. 3812-V.

CHEMICAL METALLURGIST with background in extraction metallurgy and ore dressing (knowledge of minerogy desirable) and experience in use of petrographic microscope. Required for research work in B.C. Maximum Salary $4,000. Apply to File No. 3865-V.

CHEMIST, recent graduate, required by manufacturer in central Ontario as shift chemist in Analytical Laboratory. Training emphasis on Organic-Physical and Inorganic Chemistry. Starting salary $225. Apply to File No. 3911-V.

CHEMICAL ENGINEER with considerable mechanic and hydraulic experience or mechanical engineer with good chemical knowledge and experience in hydraulics, required by a manufacturer in Ontario. Salary open. Apply to File No. 3928-V.

CIVIL

CIVIL ENGINEER to take charge of work in a drainage district in Quebec. Must be bilingual. May be recent graduate. Salary from $200. Apply to File No. 3479-V.

CIVIL ENGINEERS with experience in detailing and designing structural steel and reinforced concrete for manufacturers are required for a steel fabricating company in Manitoba. Salary open. Apply File No. 3519-V.

CIVIL ENGINEERS, recent graduate up, required by a pulp and paper company with plants in Eastern Canada. Salary open. Apply to File No. 3549-V.

CIVIL ENGINEER, age 35-40, with extensive experience in detailing and checking structural steel in buildings and bridges, required by a steel fabricating company in Southern Ontario. Salary open. Apply to File No. 3570-V.

GRADUATE CIVIL ENGINEER, required by a public utility in the Montreal area with three or four years' experience in design of reinforced concrete and structural steel. Salary $250-$300. Apply to File No. 3766-V.

GRADUATE CIVIL ENGINEER required by an industrial corporation in Montreal for design work in draughting room. Must be familiar with structural steel and concrete design. Position offers good opportunity and permanency to right man. Salary from $250 up according to experience. Apply to File No. 3785-V.

CIVIL ENGINEERS with some experience in design and field work required by a public utility in Toronto. Salary open. Apply to File No. 3813-V.

CIVIL ENGINEER, age 35-40, with considerable experience in design of structures, water supply, sewers, required by an organization in Montreal. Salary $300-$400. Apply to File No. 3820-V.

CIVIL ENGINEERS AND DRAUGHTSMEN required by an industrial organization for design and detailing of reinforced concrete for Hydro Electric developments. Location Montreal. Salary open. Apply to File No. 3864-V.

CIVIL ENGINEER, recent graduate, must be bilingual, required for public utility in Quebec City. Salary open. Apply to File No. 3878-V.

CIVIL ENGINEERS required as draughtsman in bridge department of large transport company. Preferably with experience in steel ,concrete and timber construction. Location Montreal. Salary $200-300. Apply to File No. 3884-V

CIVIL ENGINEER, required in New Brunswick. Must be qualified designer of miscellaneous public utility buildings in frame and masonry construction. Thorough working knowledge of timber, reinforced concrete and steel framing essential,knowledge of the design of various types of heating systems and plumbing. Salary open. Apply to File No. 3887-V.

CIVIL OR STRUCTURAL ENGINEER, 24-35 years required for Northern Ontario Paper mill. At least 2 years construction and 2 years design experience. Opportunity to train junior personnel. Salary not less than $350. Apply to File No. 3891-V.

CIVIL ENGINEER required by a firm in the St. Maurice Valley, to be in charge of improvements in woods operations such as dams, bridges, roads, etc. Must be bilingual. Salary $350. Apply to File No. 3902-V.

CIVIL ENGINEER required as Town Engineer of a town in the Maritimes. Required to supervise and layout work for Water and Sewarage department, works department also construction of a general nature for the Electric Light department. Salary open. Apply to File No. 3930-V.

CIVIL ENGINEER required by a Steel Company in Montreal for the design of reinforced concrete frame. Salary open. Apply to File No. 3931-V.

ELECTRICAL

ELECTRICAL ENGINEER, age 32-36, with electrical experience around mines or smelters. English speaking with working knowledge of French, is required by a company in Shawinigan Falls, Quebec. Salary open. Apply to File No. 3415-V.

ELECTRICAL ENGINEER age 30-45 with sales training with large manufacturer of electrical equipment instruments and 5-10 years experience as sales service and sales engineer required as sales engineer in Canada for U.S. firm making special equipment for transport and industry. Salary open. Apply to File No. 3447-V.

ELECTRICAL ENGINEER, recent graduate, required for the engineering staff of a paper mill in the Lake St. John area. Salary open. Apply to File No. 3507-V.

INSTRUCTOR IN ELECTRICAL ENGINEERING required for supervision of laboratory classes in power laboratory also few lectures per week, in direct current theory for Canadian University. Salary open. Apply to File No. 3600-V (G).

ELECTRICAL ENGINEER with knowledge of power apparatus, preferably bilingual, required for sales work with a manufacturer in the Montreal area. Salary open. Apply to File No. 3646-V.

ELECTRICAL ENGINEER with considerable industrial experience required as a safety engineer by a public utility in the Montreal area. Bilingual preferred. Salary open. Apply to File No. 3654-V.

ELECTRICAL ENGINEER with several years experience required as a designer by an industrial organization in Montreal. Salary open. Apply to File No. 3677-V.

ELECTRICAL ENGINEER, with general knowledge of a.c. and d.c. motors, switchgear, mercury rectifiers, transformers and other electrical apparatus, for sales work in Eastern Canada, age 30 to 35, salary open. Apply to File No. 3695-V.

ELECTRICAL DRAUGHTSMEN with several years' experience in industrial layouts for large concern in Eastern Townships. Permanent position and attractive salary available for experienced men. Apply to File No. 3701-V.

ELECTRICAL ENGINEER, age about 30, with considerable experience, required by a manufacturer in the St. Maurice Valley. Salary open. Apply to File No. 3723-V.

ELECTRICAL ENGINEER, required by an insurance company, preferably with a few years practical experience, for the inspection of boilers, steam plant and allied equipment in Montreal area. Salary open. Apply to File No. 3754-V.

ELECTRICAL ENGINEER, recent graduate up, required by a manufacturer in Montreal, for sales engineering. Preferably bilingual and familiar with rotating electrical equipment. Salary $200. up. Apply to File No. 3761-V.

GRADUATE ELECTRICAL ENGINEERS with 3 to 10 years experience in design, operation, layout of substations, switching stations, and electrical machinery, together with engineering studies, including draughting for a large hydro electric power house in Quebec. Salary $225 up. Apply to File No. 3787-V.

ELECTRICAL ENGINEER required for power sales by an electrical utility in Province of Quebec. Preferably experienced. Bilingual. Salary open. Apply to File No. 3802-V.

ELECTRICAL ENGINEER with experience in layout and design of generating and transformer stations, required by a public utility in Toronto. Salary open. Apply to File No. 3813-V.

ELECTRICAL ENGINEER under 30, required as sales engineer of switchgear, electrical and power-house equipment, by a manufacturer in Montreal. Considerable travelling. Salary $4,000. plus expenses. Apply to File No. 3885-V.

SEVERAL EXPERIENCED ELECTRICAL DRAUGHTSMEN for the design and layout of industrial power and control system, required by consulting engineering office in Montreal. Salary open. Good chance for advancement. Apply to File No. 3890-V.

GRADUATE ELECTRICAL ENGINEER, 3 to 5 years, experience, preferably in industrial electric power applications and electric control, required by consulting engineering office in Montreal, to act as assistant to the electrical engineer on design of a large industrial project.. Salary open Apply to File No. 3890-V.

JUNIOR ELECTRICAL ENGINEER with practical experience in general manufacturing industries required by an industrial organization in Ontario. Salary open. Apply to File No. 3904-V.

ELECTRICAL ENGINEER, recent graduate, required by an industrial organization in Montreal. Salary $200 up. Apply to File No. 3905-V.

ELECTRICAL ENGINEER, recent graduate, required by a paper company for work in mill equipment and power generators. Salary $225. Apply to File No. 3906-V.

ELECTRICAL ENGINEER required as Assistant Superintendent, Light and Power Department, Saskatchewan City. Must have several years experience in Utility Field. Minimum starting salary $3,600. Apply to File No. 3913-V.

ELECTRICAL ENGINEER, required for sales engineering work in Western Canada. Graduates with some selling experience preferred. Salary open, plus expenses. Apply to File No. 3915-V.

ELECTRICAL ENGINEER, recent graduate, required in Montreal for general engineering on telephone and radio. Salary $175 to $225. Apply to File No. 3923-V.

MECHANICAL

MECHANICAL ENGINEERS, preferably with design experience, are required for armament research and development in the Quebec area, in a government establishment. Salary from $190. Apply to File No. 3401-V.

MECHANICAL ENGINEER with experience in pulp and paper or mining work required by a pulp and paper company with plants in Eastern Canada. Salary open. Apply to File No. 3549-V.

GRADUATE MECHANICAL ENGINEERS for Sessional appointment as Instructors for 8 months from 1st September, 1947, and Demonstrators for 7 months from 1st October, 1947, required by McGill University. Apply giving qualifications and salary required to File No. 3600-V (I).

MECHANICAL ENGINEER with experience in the fabrication of Farm Implements, required by a Quebec firm. Bilingual man preferred. Salary according to experience. Apply to File No. 3666-V.

MECHANICAL ENGINEER with design experience in the pulp and paper industry required by a firm in the St. Maurice Valley. Salary $350. Apply to File No. 3673-V.

JUNIOR MECHANICAL ENGINEER with knowledge of precision machine shop practice and aptitude for research work in metals and plastics required for an organization in Toronto for the production of artificial limbs. Must be veteran. Salary from $225. Apply to File No. 3675-V.

MECHANICAL ENGINEERS, with at least five years' experience in the Pulp and Paper industry required by an Ontario Paper Company. Salary open. Apply to File No. 3733-V.

MECHANICAL ENGINEER with experience in heating, ventilating and air-conditioning, required by a consulting engineer in Montreal. Salary open. Apply to File No. 3773-V.

MECHANICAL ENGINEER with considerable experience willing to act as assistant to Mechanical Superintendent of a textile manufacturing concern near Montreal. Salary open. Apply to File No. 3784-V.

MECHANICAL ENGINEERS required by a Pulp and Paper mill at Powell River, B.C. Preferably with experience in plant design in the pulp and paper industry. Salary according to qualifications. Apply to File No. 3796-V.

MECHANICAL ENGINEERS, with experience in plant layout and design or ventilation problems or general mechanical design, required by a firm in Quebec. Salary from $250. Apply to File No. 3818-V.

MECHANICAL ENGINEER, age 35-40, with considerable experience in design and layout of machinery and equipment, required by an organization in Montreal. Salary $300-$400. Apply to File No. 3820-V.

MECHANICAL ENGINEERS, preferably with experience in machine design, required by a steel fabricating firm in Montreal for design and layout. Salary open. Apply to File No. 3824-V.

MECHANICAL ENGINEER, required by a manufacturer in Ontario for the plant operation staff. Salary open. Apply to File No. 3833-V.

MECHANICAL ENGINEER with six to ten years experience in maintenance and engineering work, required by alkali manufacturers in Ontario. Salary open. Apply to File No. 3833-V.

MECHANICAL ENGINEER, recent graduate up, required by a company in Montreal for toll design. Salary $175 up. Apply to File No. 3843-V.

MECHANICAL ENGINEER, with knowledge of physical metallurgy heat treatment, ability in stress analysis and design. Required for research work in B.C. Maximum salary $4,000. Apply to File No. 3865-V.

MECHANICAL ENGINEER, age 30-38, required for northern Ontario Paper Mill. Preferably with paper mill experience or experience in general layout and design. Knowledge of pumps capacities, piping, conveyors, estimating and structural design essential. Salary open. Apply to File No. 3891-V.

MECHANICAL ENGINEER, bilingual, with 4 or 5 years experience in sheet metal work, required as Plant Manager by a manufacturer in the Province of Quebec. Salary open. Apply to File No. 3894-V.

MECHANICAL ENGINEER required by a firm of Power House and Building Specialists to act as representative in the Toronto Territory. Must be familiar with that district. Preferably manufacturers' agent to act as sub-agent. Salary open. Apply to File No. 3897-V.

RECENT GRADUATE, mechanical background, required by a manufacturer in Montreal for duties leading to production. Salary $225. Apply to File No. 3901-V.

MINING

MINING ENGINEERS, with varied experience required by a firm in Quebec for general mine operation, exploitation and development work. Salary from $250. Apply to File No. 3818-V.

MISCELLANEOUS

MANAGEMENT ENGINEER with business administration and mechanical background, age 30 up, bilingual with at least 5 years practical experience, required by an industrial engineering consultant in Montreal. Apply to File No. 3307-V.

STRUCTURAL STEEL DRAUGHTSMEN AND CHECKERS, preferably graduate engineers but any experienced men acceptable, are required for a steel fabricating company in Manitoba. Salary open. Apply to File No. 3519-V.

ASSISTANT PLANT ENGINEER with paper mill experience required by a pulp and paper company with plants in Eastern Canada. Salary open. Apply to File No. 3549-V.

GRADUATE ENGINEERS, required by a large industrial and chemical organization with headquarters in Montreal for all phases of research design, operation, development, production and maintenance. Salaries open. Apply to File No. 3588-V.

CHIEF ENGINEER with industrial experience required for a steel fabricating plant in Western Canada. Salary open. Apply to File No. 3616-V.

DESIGN DRAUGHTSMAN for the design of cranes and hoists of all types, capable of making and checking complete manufacturing detail drawing, required by a manufacturer in Southern Ontario. Apply to File No. 3628-V by letter with full details. Salary open.

SALES ENGINEER with wide engineering experience wanted by a company in Toronto for the sale of textile machinery and construction equipment. Salary open. Apply to File No. 3639-V.

JUNIOR ENGINEERS, recent graduates up, as designing draughtsmen for a brewing company with headquarters in Montreal. Salary from $200. Apply to File No. 3670-V.

MINING AND METALLURGICAL ENGINEER, age about 30, with considerable experience, required by a manufacturer in the St. Maurice Valley. Salary open. Apply to File No. 3723-V.

CIVIL ENGINEERS AND ASSISTANT HYDRAULIC ENGINEERS required for government organization on West Coast for highway and construction. Salary open. Apply to File No. 3724-V.

CONSTRUCTION ENGINEER with considerable experience required for the permanent staff of a Montreal inspection company. Salary about $200. Age immaterial. Apply to File No. 3728-V

DETAILER AND DESIGNER for reinforcing steel with considerable experience required by a steel fabricating firm in Montreal. Salary open. Apply to File No. 3740-V.

STRUCTURAL STEEL DETAILER AND CHECKER with considerable experience required for checking shop details by a steel fabricating firm in Montreal. Salary open. Apply to File No. 3740-V.

GRADUATE ENGINEERS, recent graduates up, preferably mechanical, required for the engineering and operating staff of a pulp mill in Eastern Quebec. Salary open. Apply to File No. 3748-V.

PUBLICITY ENGINEER required by an electrical firm in Montreal to organize publicity department and edit trade journal. Salary open. Apply to File No. 3751-V.

CIVIL, MECHANICAL OR CHEMICAL ENGINEERS, recent graduates up, preferably with experience in petroleum and heavy industry such as chemical or paper, required by an oil company in Toronto. Salary open. Apply to File No. 3762-V.

BRIDGE ENGINEER, qualified to be in charge of the design and supervision of the construction of highway bridges. Apply stating qualifications, experience, age and salsry wanted to File No. 3780-V.

GRADUATE CIVIL OR MECHANICAL ENGINEERS with 3 to 10 years experience in design, cost estimates, draughting, and engineering studies for a large hydro-electric power house in Quebec. Salary $225 up. Apply to File No. 3787-V.

STEAM PLANT ENGINEER for large concern in Eastern Townships, with at least 5 years practical experience. Must be familiar with thermo-dynamics, combustion control, steam turbines, mechanical refrigeration, hydraulics, etc. Permanent position and attractive salary for the right man. Apply to File No. 3791-V.

RECENT GRADUATES OR JUNIOR ENGINEERS with mechanical background, required by a Montreal Engineering, fabricating and contracting firm for training purposes leading to sales and service. Area Montreal. Salary $175 up. Apply to File No. 3810-V.

STRUCTURAL ENGINEER, required by a firm of consulting engineers in Montreal for design work. Must have experience in structural steel and reinforced concrete. Salary open. Apply to File No. 3811-V.

GRADUATE ENGINEER, preferably with chemical and industrial experience, required to supervise operations at the Sodium Sulphate Plant now being constructed at Chaplin, Sask. Salary open. Apply to File No. 3821-V.

DRAUGHTSMEN required by a pulp and paper mill in the Eastern Townships for general draughting and detailing. Three or four years experience preferred but not essential. Salary open. Apply to File No. 3823-V.

DRAUGHTSMAN, preferably with mechanical background, required by a manufacturer in Montreal for design work on electrical equipment. Salary open. Apply to File No. 3829-V.

DEPUTY DIRECTOR OF IRRIGATION, Ceylon, must be Corporate Member of the Institute of Civil Engineers or possess degrees or diplomas recognized by that body. Technical duties include designing, estimating for and reporting on schemes of irrigation water supply and flood protection and checking the construction costs of such schemes. Apply to File No. 3834-V.

GRADUATE ENGINEER, age 35-40, with 10 years experience in building construction and general contracting work; to supervise design, construction and maintenance of structures for Public Utility in Toronto. Permanent job. Salary open. Send photo and full particulars of education and experience. Apply to File No. 3847-V.

JUNIOR INDUSTRIAL ENGINEER, with mechanical or chemical background, preferably with knowledge of chemical plants, required in Montreal. Salary $250 up. Apply to File No. 3857-V.

DRAUGHTSMEN of the following classes: Architectural, piping layout, equipment layout, mechanical design, steam plant, heating, and ventilating, electrical and plumbing required by an industrial organization in Montreal. Salaries open. Apply to File No. 3860-V.

STRUCTURAL STEEL CHECKER AND ONE DETAILER CHECKER wanted for large fabricating plant in Vancouver, B.C. Age between 30 and 40 years preferred. Must be experienced. Give full information and references. Salary open. Apply to File No. 3862-V.

MECHANICAL, CHEMICAL OR CIVIL, recent graduate up, required for sales and service in Alberta by a Montreal manufacturer. Salary open. Apply to File No. 3867-V.

CIVIL OR MINING ENGINEER, with executive ability, required by a construction firm in Quebec to supervise highway construction. Must be bilingual. Permanent position. Salary $300-500. Apply to File No. 3877-V.

MECHANICAL OR CHEMICAL ENGINEER, recent graduate, required by a firm in Montreal. Ability to do simple drawings, such as layout of piping and instruments. Some experience in oil refinery or chemical plant or pulp and paper would be useful. Position to eventually lead to sales. Salary $200. Apply to File No. 3879-V.

GRADUATE ENGINEERS, required for all phases of research design, operation and development by an industrial organization in Montreal. Salaries open. Apply to File No. 3882-V.

SALES ENGINEERS, required by established Canadian manufacturer of fabricated steel products. Some construction experience an advantage. Wanted for Maritimes, Ontario and Manitoba. Salary open. Apply to File No. 3883-V.

GRADUATE ENGINEER, familiar with industrial processes, metallurgical and chemical engineering as applied to steel, copper, mining and chemical plants. Broad general experience in estimating and designing. Salary open. Toronto area. Apply to File No. 3886-V.

INDUSTRIAL ENGINEER, preferably with mechanical background and several years' experience in time-studies, estimating, etc., required by a manufacturer in Montreal. Salary $250. up according to experience. Apply to File No. 3893-V.

INDUSTRIAL ENGINEER, preferably mechanical or electrical background, required in a factory in Montreal for time-study, cost control, etc. Salary $300. up. Apply to File No. 3895-V.

STRUCTURAL ENGINEER, preferably a graduate civil engineer, with experience in the design of mill buildings, required by a paper manufacturer in Eastern Ontario. Salary open. Apply to File No. 3896-V.

SALES ENGINEER, mechanical background, preferably with experience in the refrigeration field, required by a Montreal firm. Salary $250-$300. Considerable travelling. Apply to File No. 3898-V.

RECENT GRADUATES, required by an industrial organization in Montreal for training in Purchasing department. Salary $200 up. Apply to File No. 3900-V.

INDUSTRIAL ENGINEERS, preferably with mechanical background, required as Management Superintendents by a firm of industrial consultants in Montreal. Experience in time study, cost control etc. Salary $300-$400. Apply to File No. 3910-V.

RECENT GRADUATES in Electrical or Mechanical Engineering can still be offered the opportunity of being trained by large Hydro Electric Utility. Very good opportunities for regular employment in various departments at the completion of training period. Minimum salary 1st year $200; 2nd year $215. Apply to File No. 3912-V.

CIVIL OR MECHANICAL ENGINEER, interested in the sales and engineering of power transmissions, gravity conveyors and grain separators required in Western Canada. Salary open. Apply to File No. 3915-V.

GRADUATE ENGINEER OR PHYSICIST, bilingual, preferably with knowledge of X-Rays required by Canadian office of worldwide electronic concern to manage X-Ray application engineering activities. Salary $2,700 to $3,600. or more depending on qualifications. Apply to File No. 3917-V.

JUNIOR ENGINEER with some structural experience required by large milling company with headquarters in Toronto for design work on flour and feed mill buildings and equipment. Salary open. Apply to File No. 3918-V.

EXPERIENCED SALES ENGINEERS who are visiting metal and woodworking factories, general building contractors etc. in Quebec, Montreal, Three Rivers and Sherbrooke, who would be willing to take on several lines of a Toronto firm on commission basis. Apply to File No. 3922-V.

JUNIOR ENGINEER preferably with some practical machine shop or mechanical, electrical or automotive maintenance experience required in Montreal as assistant to Supt. of Equipment on testing, investigation, and designing in connection with the repair and maintenance of Car Trolley Coach and Bus Rolling Stock units and equipment. Salary open. Apply to File No. 3925-V.

AERONAUTICAL ENGINEER, required in Montreal, with 5 years experience in aircraft industry of which 3 years should have been in aerodynamics work and 2 years in advanced flight test reduction or performance analysis. Salary open. Apply to File No. 3926-V.

GRADUATE ENGINEER from a recognized University, preferably in the field of Applied Science, with a few years of industrial experience and fluently bilingual; possession or ability to obtain an automobile for transportation essential. Required in Montreal. Salary open. Apply to File No. 3927-V.

AERONAUTICAL OR MECHANICAL ENGINEER required for service engineering work on aircraft, engine and accessory overhaul in Winnipeg by large aircraft operator. At least 2 or 3 years of Air-Force, air-line or aircraft manufacturing experience required. Salary $200 to $300, depending on experience. Apply to File No. 3929-V.

GRADUATE ENGINEER, MECHANICAL ELECTRICAL or CIVIL, about 30 years of age, required by a large Hydro-Electric Utility in Montreal for Field Testing Hydraulic Turbines. Salary open. Apply to File No. 3932-V.

NOTE

In order to offer a more prompt service to both employee and employer the Employment Department is issuing each month, starting November 1st, 1947, an advance copy of the Employment Section which appears each month in *The Engineering Journal.*

All members interested in receiving this advance bulletin, kindly advise, as we are in the process of compiling our mailing list.

Situations Wanted

CIVIL ENGINEER, P.Eng. (Ont.), M.E.I.C., Diploma in Civil Engineering, University of Toronto, would like spare time work at design of structural steel or reinforced concrete on a fee basis. Would also consider checking structural steel details or estimating. At present employed in Niagara District. Apply to File No. 613-W.

CONSULTING ENGINEER, M.E.I.C., Prof. Eng. Que., Mech. '30 McGill, newly established, not fully occupied available to assist others short of staff. Present contracts in woodworking industry and commercial buildings and experience in industrial research, mechanical and heating equipment, cost studies, organization and factory layout. Apply to File No. 631-W.

GRADUATE CIVIL ENGINEER, S.E.I.C., P.Eng.(Que.), B.Sc. Queen's with some experience would accept part time work during evenings or week ends, at home preferably, on reinforced concrete and steel construction design problems, including preliminary or detailed plans. Presently employed and residing in Montreal area. Apply to File No. 1487-W.

GRADUATE CIVIL ENGINEER, M.E.I.C. Over 20 years experience in U.S.A. and Canada as designer and Superintendent of construction of dams and hydraulic Power Plants. Desire responsible position in well established firm where extensive construction is contemplated. Location immaterial. Now employed, but available at one month notice. Apply to File No. 1527-W.

MECHANICAL ENGINEER, B.Sc., M.E.I.C., P. Eng. (Que.), Queen's 1936, age 32, married; has 11 years of diversified and intensified experience to offer; including design, construction, maintenance, production, supervision, and management, in industry utilizing heavy machinery; wishes to contact companies re-openings in sales, production, or management leading to executive responsibility. Apply to File No. 2006-W.

GRADUATE ELECTRICAL ENGINEER (1939) M.E.I.C., M.I.R.E. Six years' experience in maintenance and installation of Naval Radar and Radio equipment including three years administration and supervision of large staff (both civilian and Naval personnel) engaged in such work; also two years, miscellaneous industrial experience including one year as Junior Engineer at Oil Refinery; Licensed Radio Amateur since 1932; Age 30, married, one child; interested in engineering, sales or district representative position particularly in Maritime Provinces or Newfoundland. Apply to File No. 2427-W.

MECHANICAL ENGINEER, M.E.I.C., 44 years, married, nineteen years, industrial experience, steel and iron foundries, machine shop, chief draughtsman, machine design, plant layout, cost estimating, job evaluation, time study, production supervision, work layout, foreman training, excellent in labour relations, sales representation, customer contact. Apply to File No. 2555-W.

MECHANICAL ENGINEER, Jr.E.I.C., P.E.Q., B.Sc. Age 32, married. Presently engaged in Montreal area, would prefer position in Eastern Ontario. Experience includes machine design, jig tool and die design, methods engineering, design development plant layout, engineering department organization. 4½ years as Chief Engineer. Also experience in construction industry on building, mechanical and electrical trades. Salary $425.00 per month. Available one month's notice. Apply to File No. 2682-W.

ELECTRICAL ENGINEER, B. Eng. Honors, McGill 1943, Jr. E.I.C., A.I.R.E., Prof. Eng. (Que), 26, married, presently employed, desires change to smaller organization with more general scope, broader future responsible outlook, in Ontario or B.C. Experience in heavy manufacturing, radio production, standardization, specifications, audio design. Apply to File No. 2727-W.

YOUNG MECHANICAL ENGINEER, B.A.Sc., Toronto, S.E.I.C., single, now engaged in product design and development with firm in the Maritimes, would prefer similar work in Southern Ontario requiring more technical and also more artistic ability. Apply to File No. 2818-W.

ELECTRICAL ENGINEER, (Man. '46) S.E.I.C., age 24, desires sales engineering position. Limited sales experience but possesses great potential. For full details of qualifications apply to File No. 2846-W.

WORKS MANAGER, GRADUATE ENGINEER, M.E.I.C., P.E. Ont., 15 years, experience in executive and production management in Electrical or Mechanical field. Available immediately. Toronto area preferred. Apply to File No. 2873-W.

MECHANICAL ENGINEER (Sask. 46), S.E.I.C., at present employed but available on short notice, desires position in maintenance, plant, production, or industrial engineering. One year's experience in draughting and detail work. Prefer to work in Ontario. Apply to File No. 2874-W.

CIVIL ENGINEER, Jr. E.I.C., veteran, age 31 with experience in road construction including layout, design, selection of materials as well as supervision and direction of equipment; also experience in building design, wishes to contact firm dealing primarily in earth and concrete construction or building construction, design or supervision. Location in Western Canada preferred. At present employed in general engineering. Apply to File No. 2875-W.

ELECTRICAL ENGINEER, M.E.I.C. Thorough grounding in cable manufacture development and estimating. Also extensive instrument making experience in Government laboratories. Interested in applying above capabilities in Toronto area. Present work power development. Age 26, single. Apply to File No. 2876-W.

ELECTRICAL ENGINEER, S.E.I.C., P.E.Q., graduated '46 with two years experience in electrical installations in public buildings desires any kind of work, preferably in the vicinity of Montreal, Ottawa or Toronto. Available July 1st. Age 26, married, bilingual. Apply to File No. 2881-W.

MECHANICAL ENGINEER, Jr.E.I.C., McGill '44, age 26, bilingual, single, good health. Due to an unusual situation, has not been employed in work of an engineering nature since graduation. Would prefer to locate with organization building custom-built automatic industrial machinery. Available on short notice for assignment in Canada or U.S.A. Apply to File No. 2882-W.

GRADUATE MECHANICAL and ELECTRICAL ENGINEER (M.I. Mech. Eng. & A.I. Electrical Eng. of England—M.E.I.C., P.Eng. Ontario.) with sound experience in mechanical and electrical plant and foundry production and factory management including industrial engineering methods of plant layout, job evaluation, work measurement, labour control and machine utilization; at present engaged as plant manager in complete charge of engineering works, desires to better his position. Apply to File No. 2883-W.

ELECTRICAL ENGINEER, M.E.I.C., P.Eng., age 30, married, Ex-Naval Lieut., 12 years experience including maintenance mines, process industries; elect. mfre., C.G.E. test; at present employed but seeks connection with aggressive organization. Available November. Prefer Ontario Location. Apply to File No. 2884-W.

RECENT GRADUATE, S.E.I.C., Toronto, 1947, Metallurgical Engineering. Desires position in Central or Western Ontario to gain experience in production. Interested also in Industrial Relations and Engineering. Previous experience in aircraft and farm implement manufacture. Apply to File No. 2888-W.

STEAM-ELECTRIC POWER PLANT ENGINEER, 38, B.Sc., M.E.I.C., A.M.I.E.E. 3 years manufacture, installation, and sales office experience in metalclad switchgear, protective equipment, instruments, motors, etc. 9 years practical and administrative experience in operation and maintenance of Power Plant Electrical Equipment, high and extra high pressure large capacity chain-grate and pulverized fuel water tube boilers, condensing turbines, and associated aparatus. Available November 1st. Apply to File No. 2891-W.

MINING ENGINEER—GEOLOGIST, M.Sc., M.E.I.C., Age 35, Eight years experience in mining industry; some chemical, mechanical, industrial experience. Desires position with progressive manufacturing firm in Alberta or B.C. Industrial minerals field preferably. Willing to invest in sound business. Available one month. Apply to File No. 2892-W.

GRADUATE ENGINEER, P.Eng. (Que.,) S.E.I.C., B.Sc.A. from Ecole Polytechnique, Montreal, Bilingual, would accept part time work during evenings and week-ends, at home preferably. Specialized in Heating problems, including Forced Hot Water Systems, Low Pressure Steam Systems and Air Conditioning. Presently employed and residing in Montreal area. Apply to File No. 2898-W.

PRELIMINARY NOTICE (*Continued from page 500*)

PARLEE—NORMAN ALLEN DEVINE, of Sydney, N.S. Born at South Farmington, N.S., March 23, 1915. Educ.: B.Sc., 1935; M.Sc., 1937, Dalhousie Univ.; Ph.D. (Chem.), McGill, 1939; 1930-35, lab. asst., chem. dept., Dalhousie Univ., 1935-36, demonstrator, Dalhousie Univ.; 1936-37-38, (summers), analyst, Imperial Oil Ltd.; analyst, metallographer, Dominion Steel & Coal Corp.; 1938-39, lecturer, Sir George Williams Coll.; 1939-41, research chemist and metall., Dominion Steel & Coal Corp.; 1941-42, acting chief metall., Trenton Steel Works, Trenton, N.S.; with Dominion Steel & Coal Corp., as follows: 1942-44, research metall., 1944-46, asst. chief metall., 1946 to date, director of research and development, Dominion Steel & Coal Corp., Sydney, N.S. (St. 1945).

References: S. G. Naish, C. M. Anson, J. H. Fraser, W. S. Wilson, M. R. Chappell.

RING—ALFRED JACKSON, of Chippawa, Ont. Born at Fredericton, N.B.' July 31, 1913. Educ.: B.Sc., (Civil), New Brunswick, 1940; 1937-38-39, (Summers), Canadian Copper Refineries Ltd., Montreal; inspectr., Currier Construction Co., Fredericton Co., rodman, Geological Survey of Canada, Dalhousie, N.B.; with Defence Industries Limited, as follows: 1940-41, Montreal, 1941-42, dftsman, Toronto,1942-43, supervisor, Montreal, 1943-45, Nobel, Ont.; H. G. Acres & Co., Niagara Falls, Ont., 1945-47, super- visor, and at present design engr. (St. 1940. Jr. 1943).

References: H. E. Barnett, J. H. Ings, M. S. MacGillivray, A. S. Holder, E. O. Turner, J. H. Moore.

WOODS—GEORGE MAITLAND, of Montreal, Que. Born at Lang, Sask., June 1, 1913. Educ.: B.Sc., (Mech.), Saskatchewan, 1941; R.P.E., Quebec; 1937-39, rodman, instru'man.; 1939-40, acting dist. engr., N.W. of Sask., Water Rights Br., Dept. of Natural Resources, Regina, Sask.; 1940, constrn. engr. and acting res. engr. at airports, Dept. of Transport, Regina; with Defence Industries Limited, as follows: 1940-42, foreman and then sr. foreman, Verdun works, 1942-43, supervisor of bldg. services, Westmount Tool works, 1944 to date, design engr. and equipt. inspector, special projects dept., (atomic energy project), Montreal, Que. (St. 1940. Jr. 1942).

References: C. J. McGavin, A. B. McEwan, C. H. Jackson, D. A. Killam, H. C. Karn, H. B. Hanna.

TRANSFER FROM STUDENT

ARCHIBALD—RUPERT DOUGLAS, of Port-of-Spain, Trinidad. Born at Port-of-Spain, Trinidad, April 25, 1919. Educ.: B.Eng., (Civil), McGill, 1946: 1935-41, dftsman., surveyor in mtce., Dept. of Trinidad Gov't. Rlys.; 1941-45, 4 summers with Aluminum Co. of Canada, Ltd., as jr. dftsman., Montreal, asst. to engrs., Arvida works, Que.; 1946 to date, dist. engr., mtce. dept., Trinidad Gov't Railways, Port-of-Spain, Trinidad, B.W.I. (St. 1944).

References: J. H. Reid, R. DeL. French, J. E. Dyck, H. A. Estabrook, W. L. Pugh.

ORMISTON—RUSSELL WILLSON, of Pemberton, B.C. Born at Tantallon, Sask. on May 19, 1919. Educ.: B.Sc., (Civil), Sask. 1942; 1942-43, U.S. Public Roads, Federal Works Agency; 1945 to date, resident engr. for Pemberton Drainage Project, Pemberton, B.C. (St. 1942).

References: R. A. Spencer, E. K. Phillips, G. L. MacKensie, F. McCallum E. S. C. Carpenter.

PICKERING—JOHN ERNEST, of Sarnia, Ont. Born at Prince Albert, Sask. on June 17, 1921. Educ.: B.Sc., (Mech.), 1946, Saskatchewan; summer work as follows: 1942, chainman, Dept. of Transport, Civil Aviation Branch, Winnipeg, 1943, inspector in same branch; 1945, materials expediter, Fraser Brace Ltd., Chalk River project; 1946 (5 mos.), testman, Canadian General Electric test course, Peterborough, Ont. (St. 1946).

References: F. F. Walsh, E. W. Dill, G. R. Henderson, I. M. Fraser, N. B. Hutcheon.

SCHARRY—LEO, of Montreal. Born at Montreal, Que. on Nov. 9, 1920. Educ.: B.A.Sc., (C.E.), Ecole Polytechnique, 1946; R.P.E., Quebec; summer work as follows: 1942, asst. engr. Foundation Co., Shipshaw; 1943, asst. engr. United Shipyards, Mtl.; 1944, dftsman. mech., Babcock-Wilcox Goldie-McCullough, consulting engrs.; 1946-47, elect. engr., Leblance & Monpetit, consulting engrs.; 1947 to date, sales engr., Sangamo Co., Montreal. (St. 1942).

References: L. F. Grant, J. E. Beauchemin, P. E. Poitras, J. B. Striling, H. Gaudefroy, M. Boyer, J. E. Armstrong, J. A. Lalonde.

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Community Planning Issue

COVER PICTURE

The cover picture is illustrative of what can be achieved in a properly planned subdivision. It is an artist's drawing of the Paradise Point resort subdivision, north of Port McNicoll, in the Georgian Bay district of Ontario. For a comparison with the subdivision as originally proposed turn to page 527.

THE ENGINEERS' PART IN COMMUNITY PLANNING

J. ALEXANDER WALKER, M.E.I.C.
Executive Engineer, Vancouver Town Planning Commission

An address delivered at the National Conference on Community Planning, sponsored jointly by the Community Planning Association of Canada and The Engineering Institute of Canada, Montreal, October 2nd. 1947

It is indeed a pleasure to accept your invitation to make some small contribution to the proceedings of this important conference. It is also gratifying to have the privilege of expressing my personal interpretation of the role of the engineer in the planning of communities.

During the course of my remarks, mention will be made frequently to my home city, Vancouver, and also some personal references to my own association with the planning profession and the planning movement in general. These references are made merely in order to clarify and to emphasize, and due apology is tendered for introducing them.

My initial interest in planning was incited, perhaps unconsciously, long before the term town (or city) planning came before the public. My introduction to civil engineering began with my engagement as a junior in a city engineer's office in a small Ontario city. In the course of my duties, subdivision additions were undertaken and I was impressed with the fallacy of projecting existing streets, perpetuating the prevailing grid system regardless of steep grades. The practice of designing streets to conform with the topography was not followed then to the extent that it has been done long since.

Another impression that I still recall was the practice of wealthy manufacturers building their homes, many of them mansions at that time, next to or opposite their factories regardless of the type of industry. Another condition which I could not understand being permitted, was allowing small grocery stores to be erected on the street line in a block of fine homes, each situated upon a spacious lawn. Zoning was unknown in those days, or at least given very little thought.

No Time for Planning When Real Estate Boom Was On

The date of my arrival on the West Coast a few years later was contemporaneous with a land boom. Speculation was rife and the promoters were too eager to market their lots to take time and to bear the expense for the making of topographical surveys in order to have a proper design of subdivision prepared. Too great a pressure was placed upon civic authorities to have the plans approved and in fairness to them they had very little enabling legislation to assist them in curbing the poor subdivision. Not only was poor subdivision the prevailing rule but the over-subdivision was worse. These poor subdivisions were made all too frequently over the strong protests of the municipal engineers to their councils, and of the surveyors, who did the work on the ground, to their clients.

As long as 35 years ago, some far-seeing and enlightened Pacific Coast citizens protested against the spoliation, by poor subdivision, of what would have otherwise been good residential development. They endeavoured to induce municipal councils to obtain enabling legislation to curb the then current methods of planning townsites and subdivisions.

Perhaps the greatest single factor in inducing the British Columbia government to pass a Town Planning Act was the matter of zoning. Immediately after World War I there was a lively interest in the erection of apartment blocks in Vancouver. The builders sought the best corners in the finest residential blocks and built upon 100 per cent of the lot. In addition commercial and industrial enterprises invaded residential neighbourhoods. Land values were becoming so depreciated that civic revenues were beginning to show a recession.

B.C. Town Planning Act to the Rescue

Finally, the complete breakdown of residential districts became so apparent that the British Columbia Town Planning Act was enacted in 1925. The Vancouver City Council lost no time in passing a Town Planning by-law and appointing a Planning Commission. It approved the Commission's recommendation that a consulting planning engineer be engaged and within a few months the preparation of a town plan was under way. It may be mentioned in passing that Vancouver was the first Canadian city to prepare a comprehensive Town Plan covering all the elements or phases usually associated with such planning. Point Grey, a residential suburb before its amalgamation with the City of Vancouver in 1929, was the first Canadian municipality to enact a Zoning by-law. This was done in 1922 under the provisions of a then recent amendment to the Municipal Act.

Vancouver's Plan has served as a guide in its growth for the ensuing years. However, owing to the city's very rapid growth during World War II and the City Council's desire to take advantage of the improved planning technique which has been evolved during recent years, and to be prepared for the inevitable post-war development programme, it was resolved to have a revision of the city's plan made. This revised plan has now been prepared and is in the process of being published.

The British Columbia Town Planning Act was more or less a compromise. Under its provisions, planning upon the part of any municipality is optional, although the original sponsors were hopeful that it would be mandatory. As a result during the period up to the last war very few municipalities have availed themselves of the Act. Many cities, however, appointed commissions, and passed zoning by-laws. Since the close of the war the City of New Westminster, the City and District of North Vancouver, the District of West Vancouver, the City of Trail and the District of Tadanac have had prepared or are having prepared, comprehensive town plans.

The British Columbia Government has not entered the field of provincial-wide planning but it has created a regional planning division of the Department of

Municipal Affairs headed by a former municipal engineer of many years' experience. This division has undertaken certain planning of small villages and municipalities which are financially unable to pay for such planning. Under a recent amendment to the Town Planning Act the problem of the development of areas outside the actual boundaries of municipalities known as unorganized territories, has been met by the establishment of "Regulated Areas" under the jurisdiction of the Government. Regulations covering subdivision, building, zoning, sanitation and drainage, etc. are imposed, and thus conditions which heretofore in some cases have been intolerable can be rectified. In future, these areas will have to comply with the same regulatory measures as their respective neighbouring cities.

The above remarks may be considered irrelevant to the theme of this paper but they are made in order to present a broad perspective of the planning field which will make for a more comprehensive understanding.

Growth of Interest in Town Planning

Public interest in planning has waxed and waned over the years. The work of the professional planner was just beginning to become recognized and his services just coming into demand when the great depression of 1929 developed. It was from that time onward while there was a lull in the construction of public works and the general development of communities, that his services should have been used to make plans for the future.

In the United States, under the aegis of the "New Deal" there was a feverish haste in planning. There, it will be recalled, no Federal funds were allocated to the various states or municipalities, unless and until, state and/or city plans were prepared in order to assure that the projects which were to be financed nationally, were not only useful but also properly integrated within a master plan.

The nearest analogy to this in Canada occurred when the National Housing Act was enacted. Under the provisions of this Act, no loans would be made in any municipality unless it had a Zoning by-law in operation, in order to insure the integrity of the loan. This fact created a considerable impetus to public interest in the planning of communities. As a result, professional concern in planning in Canada was revived. Professional planners were inundated with commissions. Other professional men and women—architects, engineers, landscape architects and surveyors, etc. with less experience, were constrained to undertake such planning work of various types as was offered. Never before was there such superabundance of planning to be done with such a dearth of planners.

Such a condition makes for indifference in the quality of planning. It is to be sincerely hoped that the planning now being done will be good, that the plans will be practical and the recommendations acceptable. Poor planning is usually worse than no planning at all. It will take only a few town plans to become known for their indifference and futility, to condemn planning forever in the minds of the public and civic administrations.

Town Planning a Combination of Allied Professions

Many professions are represented among the practicing planners: architects, agricultural scientists, economists, engineers, landscape architects, lawyers, physicians (chiefly those interested in public health), sociologists, surveyors and others. Obviously no one person is learned in all these professions so the services of all, or nearly all, are enlisted at one stage or another. Therefore planning is not a single profession. It is, rather, a well balanced co-ordination of allied professions. The well developed and well planned coordination of our communities can be attained only by each professional entity working together, each realizing his own limitations.

The engineer, in turn, should recognize that he has much to learn, with respect to aesthetics, from the architect and landscape architect. He must realize that his intensive technical training, his inclination to think in terms of minimum requirements, and his inherent sense of financial proportion has imposed certain limitations in regard to the principles of good taste and art. In the past most engineers have exhibited a reticence in the expenditure of funds for the purpose of embellishment or adornment of a project, as they were trained in the callous school of making ends meet.

It is my considered opinion, however, that the civil engineer, especially if he has had training in municipal engineering, and in the surveying of townsites, and most essentially if he has a fervent and abiding interest in the subject, if he is imaginative and has at least average artistic sense, is most likely to become a good planner. Above all, experience in the multi-phases of the planning field is the prime requisite.

I am not referring here to any particular civil engineer, and I do not mean that any individual engineer will make a good planner. You will not that I have made certain qualifications. During our respective lifetimes we have witnessed at one time or another, the case of an engineer graduating with high scholastic honours from an engineering school with reputed high academic standards, only to become more or less a failure in life. On the other hand, we have observed other engineers who have just managed to graduate with the allowable minimum marks from institutions of a comparatively low academic standard make quite a success in their profession. This proves that in engineering a very great deal depends upon the individual and his ability to apply his training. The same thesis holds good in planning as in any other profession or vocation.

Engineering Training and Experience Essential

The planning of communities commences in the choice of the site. Upon the wisdom of the choice—contour and characteristics of the land, availability of water supply, adaptability of the terrain for drainage and sewage, economical possibilities of waste disposal, and the like—lies the economic fate of the future community. Who but the engineer, steeped in municipal training, is better qualified to make the choice?

In the design of the street system, the fundamental structure or framework of the community, the engineer trained in planning, knowing the pitfalls and able to foresee trouble while the design is still on paper, is the most logical and appropriate among the allied professions, to carry out this work.

In the replanning, or revamping, of long established communities, it is submitted that the engineer, again conceding that he must have special experience, is best qualified to choose the best routes for heavy traffic arteries, major streets and transit routes. The engineer again is the best qualified to deal with transportation problems—the railways and harbour elements of the plan. His experienced judgment will indicate the best integration of these elements with the Town Plan in general.

What Other Professions Can Contribute

Here I am willing and anxious indeed to make some concessions and to add some further qualifications to those remarks. In the design of a subdivision the skill of the landscape architect is of utmost importance. His training is invaluable in getting the best from an artistic and practical viewpoint, from the topography of the terrain in the layout of the street system and the locating of parks and school sites. It should be pointed out that landscape architects receive a large number of lectures and considerable practical training in engineering during their academic courses. The architects' contribution in the orientation of streets in order to obtain the best possible residential sites is invaluable. In the rehabilitation of slums and blighted areas and in the planning of neighbourhood housing units the services of an architect are necessary but then again, as in the case of the engineer, he must have planning experience.

The skill of the surveyors who lay out the streets and lots is also invaluable. They have an intimate, on-the-ground, detail knowledge of some conditions that may have been overlooked by the planner and which through his good offices can be rectified.

The architects, as a profession, are unusually well qualified in the zoning element of planning. Even in this phase, however, architects as well as engineers and landscape architects, must have experience and training in order to develop a professional zoning technique. It has been noted that in many small communities, the administration of the zoning by-law is carried out by the municipal engineer, where the community cannot afford a municipal architect or building inspector. Through continuous application, these engineers have invariably developed a splendid zoning sense.

Zoning influences the designs of many public utilities such as water supply, drainage and sewerage systems, telephone plants, electrical supply systems, public recreational systems, transit systems, and the like. Inasmuch as the engineers are responsible for the designs and installations of these public utilities it will surely be admitted that the engineers have a keen interest in and an appreciation of zoning also.

In the planning of communities many kinds of skill and many types of knowledge are required. Planning is a collaborative effort. As heretofore stated, the training and experience of the architect, the economist, the engineer, the landscape architect, the sociologist and the surveyor must be utilized in some portion or another in the planning or replanning of a community. Their various views must be reconciled but the responsibility of achieving this reconciliation of viewpoints must rest with one individual—the planner. In order to successfully assume all the technical responsibility, the planner must have considerable working knowledge and understanding of each profession as it applies to planning but he need not be necessarily, particularaly proficient in any. He must be adept, however, in the profession of planning and be a specialist in co-ordination. He must have abundant technical capacity and be endowed with good judgment and keen vision.

Sounder Methods of Community Planning Must Be Developed

The great majority of those who have been practicing planning for some years were originally architects, engineers or landscape architects, the latter two professions predominating. Of recent years, younger people have had the advantage of courses in planning at various universities for varying lengths of time. Most of these courses were for the benefit of graduates in architecture, civil engineering or landscape architecture who desired to specialize in planning. However, even with the advantage of post-graduate work in planning, those best equipped to undertake planning are those who have had long-extended, varied and successful experience.

Community planning has come about largely from public protest against intolerable and unnatural conditions in cities respecting street traffic, transit operation, housing and general amenity. The engineer was responsible for the design of many of these public utilities but the unanticipated increases in population, new inventions, and the modern tempo of city life have outmoded them. It is now the responsibility of the planners, including the engineers, to bring order out of chaos. In future, sounder methods of far-sighted planning must be developed. Planning must be founded upon adequate factual data and knowledge of possible future community requirements. This is an opportunity for the engineer to broaden the scope of his professional work and to exemplify the urgency for a more all-embracing approach to community planning.

DISCUSSION

J. L. E. Price, M.E.I.C.[1]

I feel there are three prerequisites if this new Community Planning Association is to fulfil what I feel can be its destiny. We must have a form of procedure to be followed, and we must be fully informed. There must be complete understanding, and I suggest that engineers and architects who are going to be informed in the business of town planning should find ways and means of reducing the whole problem to the simplest proportions. This is important, since it must be understandable to the general public, so that they may know about the work in which the professional men are engaged. At the present time it is all a matter of great mystery to the general public. There is not the slightest reason why it should be.

Then, time is of the essence, as we all know. Many of these developments will not wait for town planning. The housing need is so vast, so tragic, that we have to go on building houses. Town planning, as it is, is trailing far behind. We have to find a means of getting it out in front. That, again, can be done.

(1) President, J. L. E. Price Company, Construction Engineers, Montreal.

I would like to point to the problem of apprenticeship training. Three years ago we were doing nothing about it, but today we are getting " on the beam " and I don't think the putting of town planning " on the beam " is going to present any greater difficulties than the problem of opening up apprenticeship training schools throughout the country. I think this job will be done.

Lastly, there is the question of the tremendous need for professional experts. I am going to give you, if I may, an outline of my conception of what I would do if tomorrow I owned a large tract of land on which it was proposed to develop a new sub-division or a new satellite town. I think it would be of interest to see what course would be followed.

First I would want the services of a competent professional landscape engineer to prepare a map of my property. Given that, I would then need the services of someone to make sub-division plans. Of course, meantime, I should need the services of someone to investigate the title; someone in this matter of subdivisions who will go beyond the old antiquated grid system. I would obtain the services of a good aerial photographer. We must not go along without him, especially if we want to enlighten the public. That is something the general public can understand.

Next I would want a topographical surveyor to prepare for me a contour map or plans. There are not many of them today but they can be trained quickly, as I know from experience. Then I would also give thought to the need for a relief map or model. There again we can quickly train young people to prepare those relief maps, and once again I would want to bring this to the attention of the general public, because the man in the street can readily understand a relief map.

With that information available I would be in a position to call in my architects and my landscape man and also my real estate expert, because now we are going to decide where to locate the streets. We must not forget the economics of the undertaking and the real estate man is the one to tell us. When it is settled as to how it should be laid out for landscaping reasons, and the real estate man has concurred with the landscape engineers that it would be economic to do it this way, I would turn to the service engineers. I would want, first, a road engineer and probably also a traffic engineer. His is a new type of job, but his planning is an important part in the scheme of things.

After the roads were located I would certainly want to go back and check that everything is correct so far. Then I would call in a sanitary engineer to tell me all about the sewers in advance. After that, a waterworks engineer would design the water supply services. Next would come the gas engineer and the telephone engineer.

In a modern development we must plan everything so thoroughly, that once the job is finished we will not have to start the next day, as is often the case, tearing down what has previously been done. I do think that in the future we have to give much thought to planning so that we can do the whole thing at once. I have never been able to understand why all these services cannot be put in together and thus avoid the interminable tearing up of streets, etc. With proper planning I know it can be done.

While there is a long list of engineer specialists today, it would appear that town planning is properly the function of the engineer; at least there will be a preponderance of his professional skill in community planning. We are going to need so many experts in engineering and architecture that the question arises " How are we going to get them? " We have to train these specialists. That means the co-operation of the technical schools and the universities and perhaps, even, the senior classes of high schools. The job has to be done quickly. How are we going to do it?

I am going to close by submitting a suggestion. I have watched the development of the Central Mortgage & Housing Corporation. I used to be very critical of the National Housing Administration, but I believe many of the things of which I was critical have been corrected. We have zones throughout the Dominion administered by Central Mortgage & Housing Corporation, and I believe it is up to them to carry the ball.

In the case of a city such as Montreal, where we have our town planning department and an exceptionally good one, that is different. But there are so many other small municipalities that are not in a position to have such a department. I think it should be the function of the Central Mortgage and Housing Corporation to do that job for them, and perhaps establish planning squads in each zone, to be available for these municipalities. No legislation is needed in this connection because they already have the power to do these things.

Stewart Young, M.E.I.C.[(2)]

Mr. Walker is to be congratulated on his presentation of "The Engineer's Part in Community Planning" He has established the fact that planning is a composite profession and pointed to the engineer's sphere of activity. Let me elaborate on one or two points.

Some hold that proper urban and rural development is best attained through attacking each problem on its own merits. These are the piece-meal planners. They think in terms of individual projects, forgetting that the whole is made of its several parts and that these parts should be correlated. The work of the piece-meal planner is no part of this discussion.

The community planner holds that, as living resolves itself into the two general activities of *home* and *work,* with a third, more or less interwoven with these two, of *recreation,* the use and development of land should be broadly divided into the corresponding basic classifications; and subdivided for residence according to the desirable degree of land occupancy and for work according to the nature of the occupation, generally into manufacture and distribution.

The setting up of a land use base is perhaps the first job in the creation of an official plan of any community, but the drafting of measures of zoning control involves several professions, including those learned in the law.

The framework of the community is the street system and, because of this, is very important. If it were not for other considerations every street would be dependent for location and width on the land use base, to provide local access. Street locations are however subject to influence of topography, while the nature and use of the surrounding territory affects the width. Moreover the street system provides a base for the distribution of public utilities such as light,

(2) Director, Saskatchewan Dept. of Community Planning, Regina.

power and telephone or sewer and water lines. All these are engineering problems.

Public recreation is necessary for the promotion of community health and happiness, and provision for it belongs to every comprehensive plan through the setting up of a well designed system of parks and playgrounds. Few engineers will claim special knowledge or skill to advise on such matters. The landscape architect is interested.

The site locations of schools, community halls, hospitals and other public buildings are important. Some are placeable in a civic centre. Others are subject to well recognized rules of location more sociological than engineering. The field of architecture is involved. Other features of an official plan are transportation facilities, airports, railroads, street railways, all involving, as Mr. Walker has pointed out, the engineering profession to a greater or lesser degree.

From the foregoing brief outline of the coverage of community planning it will be apparent that the engineer's interest is great, particularly in the street system. Every municipal engineer knows that street locations are influenced by topography, but too few realize the necessity for the exercise of forethought towards provision for tomorrow's requirements. I give two examples.

Last spring a housing scheme in one of our western cities, facing a main thoroughfare located on 66 feet of right-of-way, was under approval by the city engineer when his attention was drawn to the effect of pouring traffic from 100 new houses into a major thoroughfare classed and in use as a portion of a provincial highway. The officers of the housing organization thought in terms only of a housing scheme and were to that extent piece-meal planners. Similarly the city engineer's department failed to see beyond the outer boundaries of the housing scheme.

In another western city it was decided about a year ago to replot 165 acres of badly subdivided land. The preliminary details of discovery and design were under the direction of the city engineer. Included in the scheme was a three-quarter mile strip of relocated provincial highway on 66 feet of right-of-way. It was not until the wisdom of providing extra width for a heavy traffic thoroughfare was drawn to the attention of the city engineer that the design was altered. The approach in this case was too greatly restricted to matters of private ownership, blotting out the wider outlook of public interest.

Similarly, examples could be cited of cases in every city in Canada where, due to failure to look beyond the confines of a particular project, a resultant effect was sooner or later created in another part of the city; the unnecessary clogging of a sewer line through improper integration either within the line itself or at a remote point; a traffic jam in an area of intense development not designed for that purpose; and hundreds of other equally serious conditions brought on through lack of foresight.

The engineer's interest in community development is now great. His interest in community planning should be equally great but too often his outlook is restricted to immediate problems of the design of a sewer, laying a strip of pavement, the location of a power line, the design of a subdivision, without adequate study of the effect of the individual project on other portions of the community. In other words, if the engineer is to contribute to community planning as he should, then his outlook must be broadened to visualize each project as part of a comprehensive whole; and, otherwise, all barriers towards scientific action must be removed.

C. D. Wight, M.E.I.C.(3)

I was pleased with Mr. Walker's reference to community planning as a collaborative effort requiring the training and experience of architects, economists, engineers, landscape engineers and others. With that I am sure we are all in hearty agreement, but may I express a word of caution. Where so many professions are involved, not to mention so many persons, and where the subject is so broad, there is always a danger of some people taking a casual attitude toward it, leaving the burden to be borne by others or leaving certain matters altogether unattended to. I would like to suggest that the engineering profession would be making a grievous error if it were to adopt a casual attitude on community planning.

It is not a question of whether we wish to enter the planning field or not. We are already in it. Our daily work brings us face to face with its problems. It would be interesting to know the number of those actually associated with community planning, and the number of those others who are connected with projects which have a direct bearing on the planning of our communities. I believe that the number would be very impressive.

What is of more importance is the fact that in this country from coast to coast engineers are now occupying positions where their leadership or assistance is essential to sound community planning. I believe it is also a truth that in some of our smaller municipalities the town engineer is the only person qualified to make a worthwhile contribution to it.

I would like to mention, also, the necessity of placing emphasis on the continuity of personnel over the period of planning and the period of execution. I would also draw your attention to the ever-increasing cost of public works. The cost of developing our towns and cities has become so great that community planning is now more essential than ever before. By "community planning" I mean not just the laying-out of our streets, but the planning of all our public works, taking into consideration reasonable population increase in future years. That, I believe, is done in many cases, but we have now reached the point where it is essential that all public works of this character must be made according to an over-all plan, so that each will be a contribution to the unfolding of that plan if we are to receive our share of property development.

I want to leave with you this thought, that the importance of community planning to this nation, and the part the engineer can play in community planning, are such as to constitute a challenge to the engineering profession, a challenge that we should accept with enthusiasm and pursue with great zeal. There is no problem confronting The Engineering Institute of Canada today that is more important than that of finding ways and means of encouraging all of our members and assisting all of our members to meet that challenge. This assembly here in Montreal is certainly a step in the right direction.

G. MacL. Pitts, M.E.I.C.(4)

I want to say that I recognize in Mr. Walker, from the remarks he has made, an expert in town plan-

(3) Commissioner of Works, City of Ottawa.
(4) Architect and Engineer, Montreal.

ning. We have, unfortunately, too often listened to amateurs, and it is a relief and pleasure to listen to a man who understands the problem. As a member of the Town Planning Commission of the City of Montreal it is most interesting to hear some of the more general developments on town planning.

A remark was made to which I take exception, about following general rules in community planning. You can take down general rules, but in certain localities there must of necessity be various changes. Only the other day in Montreal we achieved one step in a small section. That was a commitment that Bonaventure Station would be removed and that Peel Street will be continued through. That is a part of Montreal's greater community planning.

Another bit of progress we hope to make in the near future is the continuance of Burnside Street through to Guy or Western Avenue. That is just local planning but it is important and has a place in the large general scheme of Montreal's community planning. It cannot all be carried out at once. You must have the general plan in front of you so the various pieces can be fitted in at the right places.

For sometime past one of the difficulties in the master plan is that the city planner can make a master plan that looks wonderful on paper, but it does not mean a thing. The trouble is that in our large communities there are a great many large organizations who have a free hand in the development of their own schemes. We have the railroads, two in Montreal; the Park Commission; the Dominion Government; the transportation system represented by the street railway companies, and we will soon have a subway system—I hope.

All those organizations have to be approached and cognizance taken of their points of view. We should have one over-all committee to talk to representatives of each one, to sit in at meetings where these plans are discussed, so such plans may be integrated into the larger overall scheme. At present there is a tendency for plans to overlap and I hope sometime soon an over-all committee will become established.

I want to pay tribute to Mr. Aimé Cousineau, C.E., and head of our Town Planning Commission, who has done a marvellous job for the City of Montreal during the time he has held office. His activities have given great impetus and inspiration to the Executive Council and the Executive Committee. The schemes being planned for this metropolis reflect to a large extent his foresight. Also in the City of Montreal I think we have one of the best technical services, the best engineering throughout all the departments of the city, as compared with any of the cities with which I have ever had any experience. Town Planning in Montreal is progressing. We are getting at the problems.

In that way we are more fortunate than Ottawa, where they have somewhat of a rural city. Ottawa is influenced by the over-riding plans of the Dominion Government. In fact, I think there was no planning. Ottawa ought to be a shining example to every city in Canada of what not to do. I doubt very much if we can ever bring it back. That just shows you what lack of planning does.

J. E. Lloyd[5]

This Maritimer has the privilege of introducing himself. I happen to be a member of the Town Planning Board of the City of Halifax and I bring to this organization the greetings of the Corporation of the City of Halifax. So far, the Halifax delegation has been greatly impressed with the efforts of this organization in its formative stages to bring about the best and most effective use of engineering skill in its application to community problems in Canada. We usually only export bank presidents and politicians, but sometimes, of course, the politicians are a sort of engineer, even though they do not belong to The Engineering Institute of Canada. There are all kinds of engineers, as you know. I happen to be one of those who does not belong to the Institute.

I thought it might be timely if one of the elected officials of a community, after serving on the City Council for many years, could throw out a point of view which might help you to find that punch in the organization which one of the previous speakers suggested you were going to need if you are going to make this organization effective in our time. It is the question of the role of engineers in Canadian communities and their efforts in those communities as related to the Province.

Democracy in Canada will never be the kind of thing a democratic Canadian wants until competent skills and talents of Canadians are developed to produce and market things that are superior to those which other people elsewhere produce to provide us with a better way of life. To me that is the challenge. Can Canadians so organize their affairs as to produce through their engineers and their other professions the highest standard of living attainable with the resources at our command? That is the challenge underlying the discussions throughout meetings of this kind.

It is the development of good management, working in the best public interest, minimizing as far as possible the undesirable things in human nature, working all together, which will allow you to achieve your ends. Good democracy to me is a challenge. Primarily the responsibility is upon the shoulders of the engineers and secondly it is the duty of the elected representatives to see that the proper policy is carried out, that competent people are selected to undertake these assignments. That is one of the issues as I see it.

This is just a thought, Mr. Chairman, from one of those Nova Scotians. We are delighted to be here and we are taking advantage of the various papers that are being read, knowing that we shall learn a great deal from them. We take this opportunity of assuring you and the members and officers of this new Association that the City of Halifax is behind you in everything you are attempting to do.

A Delegate

My question is to Mr. Walker through you, Mr. Chairman. How would you co-ordinate the opening up of public services such as sewers, water, gas, etc. in the development of the gridiron pattern, to provide these improvements to each individual lot previous to any construction, bearing in mind that the buildings are not always located in the positions originally planned? I have in mind a development representing about a hundred acres of land. I would like to get some guidance from the members of Town Planning Commissions present. What is the best approach? If I sold a lot to Mr. Walker and he was not building immediately, and if we were having the sewers and water mains put through immediately, how could we install those things now in such a way as to prevent

(5) Mayor of Halifax during war years.

changes or repairs to them later on, and yet have them in such locations that they would not conflict? I imagine Vancouver having been built up so fast, the authorities there may have faced this problem and found a solution.

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

In answering, I realize that in an old-established city where the services have been placed underground even prior to the street paving, it may be difficult to do anything about it except to go through the pavement when we want to put in service connections. In any new city or subdivision with which I have been concerned, we have always put the sewers and water mains and other utilities in and put the connection to each lot at the property line. The cost of that is naturally absorbed in the cost of the mains. Adequate records are kept as to where the underground utilities are, and when the lot is sold or the house is built the builder or contractor will know exactly where the utilities are as well as the grades of the sewers, and will be able to make sure they are all right for drainage purposes and that basements are not going to be flooded on the respective grades when the house is built back from the street. It seems to me it is only the logical thing to do to charge all these services against the general project.

Charles Flint, M.E.I.C.[6]

Mr. Young of Regina mentioned that from the point of view of future air travel developments, some thought should be given to the construction of airports. My suggestion is that where a development is contemplated, and particularly an industrial development, the planner should consult with the district airways engineer of the particular district in which the project is to be located. Certain things have to be established such as flight conditions and conditions for visual or instrument landing. From the point of view of airport planning it is essential that obstructions be clearly noted and all other factors which might interfere with the flight of planes either descending or ascending.

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

Mr. Flint's remarks are timely. I may say that the revision of Vancouver's plan to which I just referred covers a metropolitan airport plan. We have issued plans for one very large airport and four or five other airports of minor character have been provided for. They are graded as to landing strips and even in our zoning we take cognizance of air strip zoning, which is necessary according to the regulations of the Department of Transport.

(6) Superintendent of Construction, Department of Transport, Air Services Branch, Ottawa.

C. A. Meadows, M.E.I.C.[7]

I think, with all respect to Mr. Walker, that this meeting will be missing the boat if we don't give consideration to one very important angle, and that is the matter of engineers offering themselves to serve in the role of officers of the municipal government. I know that engineers are conscious of this because in the last annual meeting of the Association of Professional Engineers of Ontario I made a rather informal motion to the effect that the Council should take steps to encourage engineers in every important municipality across Ontario to offer themselves as aldermen or members of the city council.

Now we are engineers who are taking part in what we might call the technical side of planning. We ultimately come up against the fact that the implementation of our plans very largely lies with the municipal council. From time to time I have to sit and consult with some 30 municipal councils in Ontario, and in all those councils I do not know one single engineer. It actually requires a great deal of patience to sit and hear the discussions and deliberations of lay councillors on the subjects relating to engineering. Really they don't know very much about it, and I have often said how refreshing it would be if there were even one single engineer, with average engineering training and concept, who could take part in the discussions and give some engineering leadership and guidance in the problem in hand.

I throw out this thought before this meeting of the E.I.C. and the C.P.A.C., that we should give consideration to taking definite steps to encourage our engineers to take part in municipal government.

P. Alan Deacon[8]

I am not an engineer. Following Mr. Meadows' remarks the thought came to me that perhaps the E.I.C. should do a little educating of some of its members who are now politically conscious and who now occupy situations where their influence could be felt.

F. F. Dyer[9]

I have very little to say except that I enjoyed these talks this afternoon and fully realize the obligations engineers have in this problem. As the lone member of our city council and for the Province of Ontario, I would emphasize the importance of engineers presenting their plans in such a way that the general public can understand and follow them. That has been one of the greatest difficulties I have seen in getting our plans accepted. The average engineer is apt to be more on the technical side, and forgets that the public recommendation is part of it; my opinion is that this is the biggest difficulty that engineers as a body have to overcome.

(7) General Manager, Meadows, Critoph and Company, Toronto.
(8) Architect, Toronto, Ont.
(9) City Engineer, Sarnia, Ont.

REPLANNING OUR CITIES
OUR NUMBER ONE PROBLEM

LESLIE WILLIAMS
City Planner and Transportation Engineer, New York, N.Y.

A paper delivered at the National Conference on Community Planning, sponsored jointly by the Community Planning Association of Canada and The Engineering Institute of Canada, Montreal, October 2nd, 1947

Although this paper is based on conditions and statistics prevailing in the United States, the situation in Canada is very much the same and the remarks are equally applicable to this country.

Mr. Williams first describes the present unsatisfactory conditions prevailing in our cities and the tendency toward uncontrolled *decentralization. He next indicates reasons why we cannot allow such tendencies to persist and outlines how transportation is a major force which can be used for the control and direction of urban growth.*

Having stated the problem he proceeds to an outline of the "fluid city of the future" and concludes with his recommendations for the achievement of this idealized community.

Mr. Williams' address is followed by the prepared discussion which was presented to the meeting by several Canadian authorities in the fields of transportation and city planning.

Our number one domestic problem is the replanning of our cities to meet the requirements of the Automotive and Atomic Age in which we live.

What is going to happen to our cities? Are they destined for better or worse? At present they are full of infirmities. Around central business cores is a ring of blight. Middle-aged residential neighbourhoods are riddled with vacant lots and lack of adequate recreational and public service facilities. A frowzy fringe of junk yards, honky tonks and papier maché subdivisions frame the city and line its approaches.

Our cities are ripe for redevelopment. Housing authorities place the U.S. housing needs at a million homes a year for the next decade. The U.S. Public Health Service reports an $8-billion deficiency in water supply and waste-disposal facilities. Road builders expect to spend about $1¼ billion in 1947 mostly for repairing the existing highway system. Billions more are required to modernize obsolete and outmoded plant and equipment to meet present needs.

Our cities are also in serious financial difficulties. Central cities in metropolitan areas are losing a large percentage of their resident population and many of their businesses to the outskirts. Central business area values are very unstable. Public officials are faced with a dilemma of how to meet increasing operating costs and how to compensate for falling values and still rehabilitate blighted areas and relieve traffic congestion. As if this were not enough, reinforcements for accelerated urban disintegration are on the march. The U.S. Federal Works Administrator recently adopted a National Interstate Highway System, consisting of approximately 40,000 miles of express highways criss-crossing the continent and going through 182 of the country's 199 cities, having populations of 50,000 or more. Four and a half million motor vehicles will pour from the assembly lines of the U.S. motor factories onto its streets and highways in 1947; in 1948 probably 5 million more. In 1949 the automotive industry will try to surpass its previous all-time record of 5 1/3 million motor vehicles manufactured in 1929.

In the U.S. ¾ of a million non-farm family housing units will probably be started in 1947, but a greater proportion than previously is being concentrated in unzoned and otherwise uncontrolled outlying areas. This will continue until central cities are drained of a sizeable percentage of their present resident population.

Housing and Highways, unplanned and unrelated to each other, can result only in an accelerated *uncontrolled* decentralization—bad for cities, suburbs and surrounding countryside. Unless effective steps are taken to guide urban growth along sound lines before the forthcoming housing and highway building booms reach their full tempo, our cities will be destroyed as effectively from within as bombing from without destroyed the cities of Europe and Asia.

We don't have to be atom-bombed to be eclipsed.

Our cities are worth saving. They form an important part of our economy. They are probably our greatest national resource. Where would we have been in the last war without our great urban potentials. The rise and fall of great nations is told in the growth and decline of the cities. Are we going to sit complacently by, debating the relative place of engineering or architecture in city planning and let *happenstance* be our guide? Or are we going to assume our civic obligations and take the initiative by consciously guiding the growth of our communities along organic, functional and attractive lines?

We have no choice. If we complacently sit back babbling among ourselves, the present trend in urban disintegration will be the spark which will explode the distended city of today into a chaotic, disorganized and jumbled mass of conflicting land and property uses of tomorrow. We have a job before us requiring courage and imagination. This is no simple coloured crayon and tracing paper design problem. This is a challenge going back to the fundamentals of urban growth. The configuration—the layout—of a city is the product of many forces. We must ferret out, correlate and assess these forces directing urban growth and harness them in the public's good.

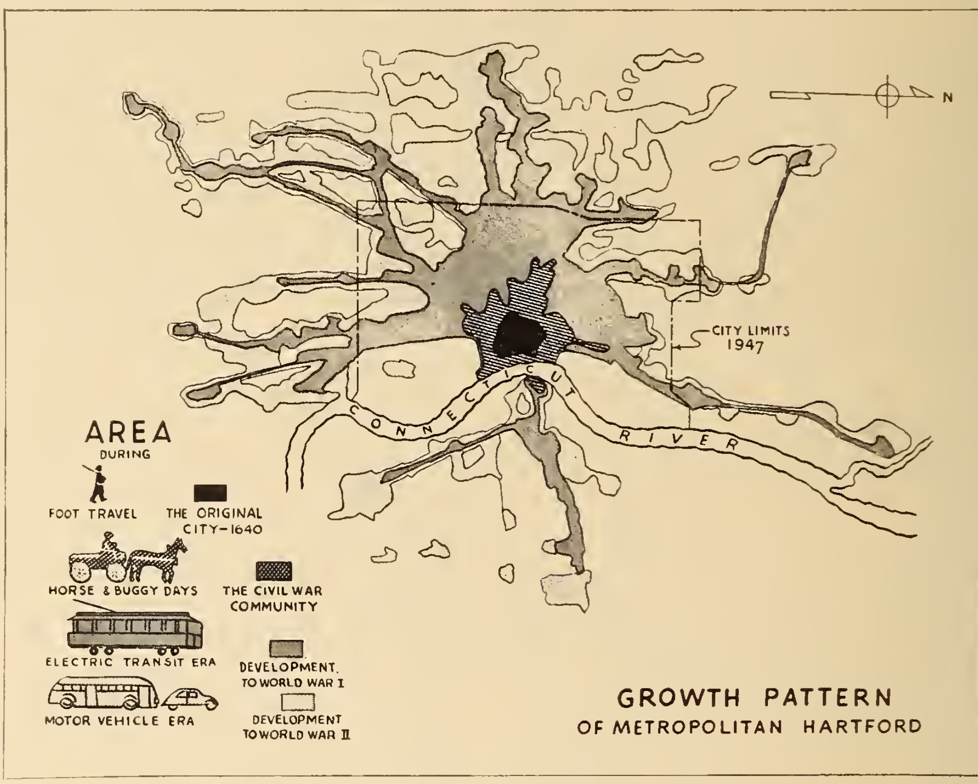
Transportation is a major force. Examine a map showing the growth of your community and see how succeeding advances in transportation have been a major force directing and controlling the pattern of its growth. A little over 50 years ago our cities were compact communities, the shape and extent of which were determined by foot travel, but with the coming of the street railway, they were transformed into a star-shaped pattern with development taking place along mass transportation lines. Then an amazing thing happened in the early 1920's. Automotive enterprise mixed up a strong batter of gasoline, rubber and cement. "Autopia" was here! The configuration of our cities took on the suburban spread. Millions of motor vehicles, rolling on pneumatic tires over paved roads sprawled our cities out, like misshapen monstrosities, over the surrounding countryside.

The flight from the city was on! *Uncontrolled* decentralization grew into a national urban disease. This identical process is going on everywhere in this American Kingdom of the Automobile. All our cities are facing the same phenomenon. They differ only in having different circumstances and different topography. Transportation has been, is and will be a major force directing the pattern of our cities. Let us put this force under the microscope.

The movement of people and goods is the lifestream of the city. It is the dynamic element in the civic organism which breathes life into an otherwise static arrangement of streets and land uses. Flaws in the circulatory system impair the normal functioning of the city. Traffic congestion impairs the accessibility of the downtown section and is a major cause of the loss of millions of dollars of central district values. Traffic delays and conflicts are spreading out along our thoroughfares like a conflagration, searing values and inflaming the swollen blight fringing central business districts.

Most cities suffer from a double dose of traffic congestion daily. Every morning traffic pours into urban centres and fills them to overflowing; and then in the middle of the afternoon flows out again, reaching flash flood proportions around 5 o'clock. Life today in our metropolitan centres has become one constant "daily double" for adults—struggle intown to work in the morning and struggle out at night.

What is to be done about it? The key to the traffic problem is not found in chasing from one accident location to another with a bundle of "Go Right" signs in one hand and red, yellow and white paint brushes in the other. The answer is not in dropping old tires or saw horses in the middle of complicated intersections nor in relabelling ordinary streets as "express streets". The traffic problem will not be solved with a "good five-cent parking meter" or by theorizing how to keep the cars out of the centres and still keep the customers coming.



THE EXPLODING CITY OF TODAY

This indicates how our cities tend to expand along the lines of major transportation arteries. By controlling the growth of these transportation routes the development of the city can be more logically planned.

Traffic engineers and the police are doing a marvelous job getting the maximum use out of existing streets and highways by one-way movement, modernized and coordinated traffic signalization, and the elimination of curb parking, promoting safer and more expeditious movement of people and goods. It is amazing how much latent traffic capacity is in our so-called out-moded horse-'n-buggy arteries when the traffic stream is cleansed of curb corrosion.

Mass transportation and staggered hours have been advocated as the cure-all for congestion. Staggered hours worked in wartime, but the peacetime worker apparently looks upon the staggering of working hours as straight castor oil—too harsh to stomach. There is no argument against the fact that motor buses, trackless trolleys and street cars are efficient users of street space; that they are the safest and most economical form of urban transportation yet devised and that they require no parking space. Yet transit riding is beginning to fall off.

We must hold the line. In large cities such as New York, Chicago, Philadelphia and Boston, which have rapid transit systems, three out of four trips to the centre are made in public transit vehicles. You can imagine what the situation would be like if it were the other way round. The public's concept of transportation has grown with the increase in the general standard of living. Young couples, dreaming of the delivery of a shiny new car, develop a strong distaste for the long, tedious journey to and from work. Therefore we must provide efficient and attractive mass transit in the best interests of the community as a whole.

We often hear that the "only possible solution" for traffic congestion is to build elevated and depressed motorways into and through our central business districts. We know there is inadequate auto access to business centers but we also know that cities do not know what to do with the cars that superhighways now dump into the downtown. Our existing streets were not designed for the "automotive age" and we must modernize and supplement our existing thoroughfares. It has yet to be demonstrated however that the digging of "autopic" ditches through business districts as the "only possible solution" for traffic congestion.

Panaceas for traffic congestion are as numerous as ball point pens. Up to the present our approach has been mostly piecemeal and negative. We have been trying to solve the traffic problem by killing traffic and naturally many are a bit disorganized in their thinking. We must use a positive approach to provide a permanent remedy for the movement of people and goods in urban areas.

Traffic is interwoven with the street system; streets in turn with terminals; and terminals with abutting land uses which, all together, go to form the city. We need comprehensive community planning on a metropolitan-wide basis, more now than ever before, to direct the exploding city of today into an organically arranged metropolitan community of communities of tomorrow, to save our economy from collapse and ruin. We cannot afford to let *uncontrolled* decentralization continue unabated. It is too wasteful. It breeds blight inside and outside the city. Suburban slums are as destructive as are the common intown variety. Our cities are the major markets for all the goods the U.S. produces. Cities are the centers of marketing, of competing ideas and achievements in the arts and sciences. The nation's wealth and power stem from its cities. We need to guard them well.

But, the urban market for a great many of our national products is being restricted. Antiquated building codes and methods are forcing new building out of cities. Traffic congestion is stunting the normal expansion of modern transportation.

For example, automobile manufacturers once looked to a future of one car for every three persons in the U.S. All this seems to be another automotive hallucination. Over 80 million persons, or 60 per cent of the population of the U.S., live in urban areas; yet the 40 per cent rural dwellers own the bulk of the cars. Why? Traffic congestion and the costs of operating and garaging a car in cities stifles its use. In other words, the urban customer, who buys the high-grade tires, gas and oil is being choked off. An iron curtain is being drawn around urban areas restricting the growth of the automotive industry.

Business interests are becoming alarmed. The automotive industry is a large market for the goods we produce. One out of every seven persons gainfully employed in normal times was directly or indirectly so employed as a result of the automotive industry. Big business is beginning to realize that as soon as war deficiencies have been made up, the market for a number of urban products, including new automobiles and all the products connected with the automobile and road building, will be definitely curtailed; unless a more positive and comprehensive approach is made toward a solution of the urban transportation problem. Profitable dividends will diminish for the construction, concrete, asphalt and steel industries; for automotive, gasoline and tire manufacturers. Business will fall off for department stores and hotels; and real estate owners will again be seeing large red spots on the ledgers. Everyone who lives and works in cities and is otherwise dependent upon the urban market for a livelihood will be adversely affected. The consequences are tremendous for a relapse in construction and manufacturing is reflected in deep dips in business and employment.

Let us not however run to the wailing wall. It is possible that the fear of an economic collapse in the face of a growing public desire to force our standards of living higher might bring about a coalition of the man in the street, his government and big business for comprehensive community planning. We have in the making factors that could bring the full force — the great power — that lies behind *individual initiative* into this problem. Private initiative and government are necessary to a permanent solution. Perhaps, we stand on the threshold of a great era of urban replanning and redevelopment — the beginning of a great American Renaissance.

We have a *problem*, and no simple problem to be solved by any group of engineers or architects over a luncheon or draughting table. This is probably the most complicated problem ever set before mankind.

We have the *tools* to rebuild our cities. We have the *wherewithal* for the present waste from urban inefficiencies runs into billions of dollars annually. We have the *know-how*. Professionals from all over the world come to our shores to learn our techniques.

Fortunately, *the Fluid City of the Future*[1] is already evolving under local pressure. I visualize this city as a series of cellular units devoted to living, working, learning and playing, arranged organically by neighbourhoods and communities and linked together by means of a balanced system of transportation. Radial freeways, circumferential parkways, modernized major thoroughfares and adequate terminals for automobiles, transit vehicles and trucks form the framework for the land uses, and serve relocated key industries, reconditioned residential neighbourhoods, new parks, revitalized business districts and self-contained satellite suburbs.

The Fluid City of the Future is based on the thesis that, if we concentrate on developing a system of transportation which will meet the *desire trends* of population, then the land use interstices will adjust themselves into an harmonious and functional arrangement promoting the public's best interests.

It is possible even now to see this city beginning to

[1]The Disintegration of American Cities, by Tax Institute, N.Y., June-July, 1947.

take shape. Population and land use trends point to a pattern with a less populous central city with more open space, catering to an expanded market region and serving as a great work center for an enlarged commuter population living in the surrounding "rurbanic" countryside.

It is our job to guide and control these forces to produce the best possible arrangement of space for living, working, learning, playing and also for travelling around in the metropolitan area.

We need a plan — a People's Plan. One that will fill every last citizen with enthusiasm One that will provide a common ground for private initiative and government participation. One for which the people's representatives will feel justified in appropriating public funds and in which the bankers will feel safe investing the people's money. We should aim to—

Decongest and revitalize central business districts

Rehabilitate and redevelop slum and blighted areas

Protect and preserve existing residential neighbourhoods

Guide and control outlying developments in accordance with a Master Plan

Review and rationalize the tax base and financial structure of cities.

We can achieve this goal only by proceeding along a hard, cold, factual path. We must proceed from a careful appraisal of what we have, to an estimate of the city's economic potentials; and then to a general Master Plan of development showing not only express highways, but also terminals, existing street and transit improvements, parkways, parks, public utilities, public buildings and areas for private residential, commercial and industrial purposes. When this picture of future possibilities has been adopted, then the Master Plan should be supported with modernized building, zoning, sub-division and other planning legislation and also by a rational programme of public works and financing, capable of translating plan into reality

This is the path to the organic and functional city of tomorrow; but let us take our first steps along this path with a quantitative analysis of that major force directing the pattern of our cities — *the movement of people and goods.*

Engineers have a large stake in this phase of the problem. Engineering plays a major part in all phases of City Planning. It provides not only the highways, bridges, railroads and other transportation facilities which circulate people and goods, but also water, sanitation, electric, gas and other public services and facilities without which our cities could not function.

The replanning of our cities is not however a one-profession or a one-industry responsibility.

We must — all of us, from all walks of life — unite and assume our civic obligations for directing the planning of our communities, or we will wake up one of these days to find that the bombed-out and rebuilt cities of Europe and Asia have become the New World and we the Old World of the future. Let us, as engineers, join with our colleagues in the architectural and city planning professions and work with private groups and public agencies to produce on this continent, communities which will shine as beacons of our way of life in this troubled world.

DISCUSSION

Dr. Aimé Cousineau, M.E.I.C.[2]

It is an honour for me to have the opportunity to add a few comments to Mr. Leslie Williams' paper. It is a thoughtful presentation of the problems related to the physical planning and replanning of communities. Yes, indeed, the need for rehabilitation should be better understood, and city planners should tend more and more to correlate their activities, not only towards effective decentralization, but also the regeneration or renovation of blighted areas.

The movement towards decentralization of cities has created new problems and economic waste. This is partly attributable to unsuitable use of land and inadequate distribution of open spaces. On the other hand, if controlled decentralization, through regional planning, has corrected over-concentration of population, it has caused internal degeneration of central areas, and with these migrations have come in most great cities, demolition, parking lots (although necessary), slums and other changes in urban land use that shrink taxable valuations and pile up delinquencies.

It becomes more and more evident that communities must be planned and their activities correlated against haphazard developments, in order that their growth may be accompanied by the stabilization of real estate and the preservation of amenities. This stabilization, as pointed out by Mr. Williams, can be obtained by zoning. In many cities, blighted districts are the result of uncontrolled growth, and certain areas have deteriorated long before the decay of the buildings they contain. Hence, the development of a city, which is a changing, usually growing organism, can be regulated first, by a comprehensive plan, and second by zoning which should implement the plan. Modern cities have tended, among other things, to produce overcrowding. This may be attributed to the absence of a master plan correlating its different elements: circulation, zoning, housing, open spaces. Moreover, it also becomes obvious that cities must be planned and their activities correlated in terms of transportation, and in our city for instance, this problem has been the object of numerous studies. The system of railways is complex and preceded the establishment of the city master plan. Public transportation inside the city is also a problem of the utmost importance. In the matter of balanced urban development, may I say with our guest of honour, who is largely responsible for having created in the United States and Canada a better understanding on these questions common to both transportation and city planning agencies, that the interests of public transportation and city planning must never be divergent, since, only with the integration of transportation with the other elements of a master plan, can the best interests of the community be promoted.

With regard to the traffic situation, we may point out that an early solution must be found to relieve congestion due to the huge concentration of commer-

[2]Director of the Montreal City Planning Department, Montreal.

cial activities in the central business districts of cities. Conditions are particularly aggravated in Montreal, owing to its topography and the many narrow thoroughfares in the down-town area.

We must recognize that traffic in urban centers is composed of a number of elements each with its own characteristics yet dependent on others. The improvement in any one form of transport is reflected in improvement in the other forms. With this thought in mind, our city is considering the possibilities of widening or extending certain streets to permit the necessary development of the down-town area, erecting expressways and facilitating the construction of subways as the principal methods of reducing traffic congestion and speeding up public transportation. All these proposed improvements are related to our master plan which aims at improving the system of arterial streets, relieving congestion in the down-town area, connecting the arteries with provincial highways, and finally, assuring the rapid transportation of the masses, and establishing easy communication between the city and the harbour, railway stations and freight terminals.

Reverting to general principles, let us say that planners are aware that attempts have been made to promote the orderly dispersal of the population from congested areas. Railroads, transit lines and highways have largely contributed to this end. The decentralization of industries and population from large cities in favour of rural and semi-rural locations is less probable in well-planned and zoned communities.

In the light of the modern conception of city planning, a comprehensive or master plan should logically precede zoning ordinances. It is now realized, in cities which have been pioneers in this important element of planning, that zoning should have been framed to implement the master plan. The consequences are that, with the carrying out of this plan, the revision of zoning ordinances is inevitable, especially in connection with the excessive allowances made for commercial use in the original ordinances. Likewise, it has been reported that, in cities which have failed to fit certain individual solutions into a composite whole, the zoning ordinances are being modified, having been too prodigal with industrial and business areas.

The development of extensive suburban areas has given rise to satellite cities, garden cities and dormitory towns which have greatly contributed to the improvement of housing conditions. On the other hand, the natural growth of cities along new lines of communications has led to the casual development of uneconomic and half-developed subdivisions in the suburbs. This unplanned growth has created, among other things, a great number of substandard dwellings with inadequate recreational and public service facilities.

I may sum up these few remarks by quoting this thought from Mr. Williams' paper: " We can achieve our goal only by proceeding along a hard, cold path. We must proceed from a careful appraisal of what we have, to an estimate of the city's economic potenials "; or quoting another authority: " It is not the cost of planning which should concern communities, but the cost of lack of planning." We may now consider that city planning ideas are advancing and that whoever values the greatness and prosperity of his community and is directly interested in its progress, will find Mr. Williams' paper, subject-matter for reflection. We are grateful to him for having presented it.

PICTORIAL RESULTS OF A CITY TRAFFIC SURVEY

By using diagrams such as this typical example, the planning engineer provides himself with an essential tool for the preparation of a master plan for the community. Illustration courtesy of Dr. Aimé Cousineau, M.E.I.C.

D. E. Blair, M.E.I.C.[3]

There are two distinct and separate phases of town-planning. One has to do with the relatively simple control of new developments on the fringes of the populated area and the other covers the much more difficult and costly matters relating to the correction of the unconscious errors of our forbears who built well but not too wisely.

In the final analysis of our local situation, we find that our troubles are due to two principal causes. First, inadequacy of the facilities available for the transportation of goods and people, and, second, the natural topography of the site of our beautiful city which results in excessive concentration of traffic between mountain and river and on the north-to-south arteries immediately east of the mountain.

The latter conditions are exaggerated by the necessity for a preponderance of left turns in the flow of traffic.

Mr. Williams has reminded us that real-estate values and hence, tax revenues are decreasing in the congested areas of our larger cities He has drawn attention to the common and dangerous practice of allowing uncontrolled development of housing centres on the fringes of our cities without regard to the effiiciency of the transportation facilities upon which the residents of these mushroom growths must depend for their convenience in moving to and from their work in the business and manufacturing centres. He has drawn a picture of the millions of new automobiles which will soon be fighting for accommodation on our overcongested streets. He calls our attention to the tendency towards the star-shaped outlines of our city maps showing large areas of undeveloped land in between the points of the star. This pattern of development may have many undesirable features if the question of efficient mass transportation has been ignored.

There is a marked tendency for the average individual to apply small-town theories to the solution of the problems pertaining to the movement of traffic in our larger communities.

We, in Montreal, have passed the small-town stage and the solution of our traffic problems demands the immediate and co-operative application of improvements whose effect will be beneficial, as far as possible, to all users of our streets. It will not do to confine our efforts to the easement of conditions that are distasteful to any one group without regard to the effect that these improvements may have upon the interests of other groups.

In the settlement of such matters, it is rarely, if ever, possible to satisfy the personal views of every individual affected but the main object of our study should be to reach a compromise that will result in the greatest good to the greatest number. The function of the purveyors of mass transportation is to provide the means whereby the population of the city, both permanent and transient, may move from place to place as quickly, safely and economically as possible. In our efforts to provide an adequate service, we are frustrated at every turn by the congested condition of our down-town streets. The resulting slow movement and confusion affects the lives of all the residents of the community.

The central business areas of all large cities present a picture of costly and solidly built structures that are served by an inadequate street pattern. Widening of these streets, up to a certain point, may provide some relief but at a staggering cost and the net result is usually that the extra width is given over to parking. Moreover, the area available for permanent structures is substantially reduced, especially in cities such as ours, where city blocks are very narrow.

The efficiency of such widened streets will be adversely affected by the fact that fast, through movement is incompatible with the slower movement and necessary stoppage of trucks and mass transportation vehicles.

Segregation of these different forms of transportation is obviously desirable.

In view of these facts, is it not obvious that what we need is not so much the widening of established streets as the building of additional streets. There is no room for such new streets on the surface unless we eliminate valuable structures by means of expensive expropriation proceedings. In view of these prohibitive expropriation costs and lack of physical space for new streets on the surface, is it not rational to examine the possibilities of establishing new streets or channels for traffic on a second level. Elevated structures have been tried and found wanting, except under certain very limited conditions such as existed on the waterfront of New York.

Because I represent the mass transportation interests of the city, you may perhaps expect me to express any opinions that I may have as to a solution of the problems that face us. I think that our city planners must place first things first. They are expected to give us a long term plan, costing many millions of dollars, to be expended over a period of years. I would suggest that the first thing to be done should be to utilize our existing street facilities to the utmost advantage, and that, immediately. This means the abolition of street parking wherever such parking interferes with the free flow of traffic, regardless of the fact that such a restriction will cause some inconvenience to a relatively small group.

They should continue their present policy of establishing more one-way streets, eliminating left-hand turns where possible, make improvements in street signals and ensure effective police control of traffic.

When these things are done, what should come next?

We of the public transportation organization, who are concerned before everything else with the expeditious movement of people, are convinced that the greatest good to the greatest number of our citizens will result from the building, in the congested parts of the city, of new, underground streets in which public vehicles will be segregated from other forms of traffic. This will not only provide far better transportation facilities for a large majority of our population but will make room, on the surface, for the freer flow of a larger number of other venicles.

Geo. A. McNamee[4]

In one of Mr. Williams' recent addresses, which I had the pleasure of reading, I was particularly interested in his remarks outlining the chief reasons for building expressways:

To reduce and not produce traffic congestion
To alleviate and not aggravate traffic accidents
To preserve and not imperil central area values
To encourage and not discourage sound suburban development.

[3]Vice-president and general manager, Montreal Tramways Company, Montreal.

[4]Manager, Royal Automobile Club of Canada, Montreal.

The Royal Automobile Club of Canada, as many of those present know, is a non-profit, non-political organization. Several thousand local motorists are banded together to promote, among other things, traffic improvements.

The Club's resources are devoted primarily to services for its members but much of our work is to the advantage of the community at large. Our members have contributed to a special fund for the purpose of educational activity towards the construction of modern facilties for transportation in general. We say " transportation in general " because all forms are interrelated in the case of both urban and suburban thoroughfares.

We foster sane and just legislation and interest ourselves in the promotion of safety regulations. We have always taken an active interest in promoting the construction and maintenance of highways to meet the constantly growing needs of road transportation.

Traffic problems have been creeping upon us for years but little has been accomplished to date. The time for action on the part of our authorities in the Metropolitan Area is at hand. The adoption of definite plans for the Island of Montreal is a matter of urgency. There must be an overall planning so that the physical improvements contemplated will fit in to a uniformly co-ordinated system cf communications which will adequately serve all sections of the Island and contiguous territory.

We are all agreed that traffic in the Metropolitan area must move expeditiously, safely, continuously and economically if we are to progress and our transportation services are to fulfil their proper functions.

Provision must be made for the movement of vehicles without congestion. Adequate parking privileges must be provided; loading and unloading facilities must be afforded in such a manner that the flow of traffic will not be obstructed or impeded. There must be a public realization of these fundamental needs or there will be a serious decentralization of business and deterioration of residential districts with consequent territorial depreciation of property values.

As citizens we are all users of the mass transportation form of conveyance and resent being delayed by obstruction on the part of other vehicles using the public thoroughfares. As motorists we wish to reach our destination within a reasonable period of time and we are not satisfied to speed up on one thoroughfare only to be delayed on another. There must be overall expedition. If traffic were able to move more quickly to its destination, a lesser number of vehicles would be required and this would reduce the number of commercial vehicles using the public thoroughfares.

It must be fully recognized that in Montreal, as elsewhere, motor vehicles are used, almost exclusively, in transporting the necessities of life from factory to terminal, to store and to residence.

While we are interested in transportation generally, we are in particular concerned with the flexible type i.e. the motor vehicle. The importance of this class of vehicle alone, in Montreal and environs, assumes gigantic proportions when we realize that within the bounds of the Metropolitan area motor vehicles travel a daily average of close on to 3,000,000 miles.

Motor vehicle registrations are increasing beyond the imagination of the average citizen. Three years ago Montreal and environs had less than 70,000 registered owners; today we have over 100,000. To this must be added the increase in the number of out-of-town vehicles which daily use our streets carrying farm products, industrial materials, commercial travellers and tourists. Our arteries thus serve not only local but provincial, interprovincial and international traffic. I will leave it to the imagination of the individual to estimate the increase in local traffic when motor vehicles are in full production.

We have need of controlled-access expressways, overhead or depressed, viaducts and skyways, service streets and grade separations that will enable all kinds of traffic to move safely and expeditiously, and this includes public utilities for the handling of mass transportation.

These devices will cost money, lots of it, but the lack of these improvements is today costing us more than the cost of their construction.

We suggest an entirely new type of architecturally designed artery for the Metropolitan area, something more than the mere widening of existing thoroughfares. Modern east and west, north and south expressways will require the demolition of outmoded buildings and a few of the larger structures in order to provide a width of right of way for the immediate and anticipated traffic needs of the future. Their use will be controlled and cross-town traffic will be under or over-passed. They will quickly drain the local traffic in the various districts through which they pass and will at the same time afford many parking places. These expressways will handle mass transportation vehicles as well. There will be no stop signs or traffic lights; congestion will be eliminated. Their location can be quite adjacent to the heart of the city. They will do away with much of the slum areas and encourage decent homes and neighbourhoods.

Much could be said concerning existing conditions, but I would like to place before you a few suggestions which we in the Royal Automobile Club of Canada advocate for the relief and safety of traffic:

1. The need for the creation of a METROPOLITAN TRAFFIC AUTHORITY (or Board or Commission, or whatever you may wish to call it) to coordinate all existing organizations or bodies, such as, municipal administrations, planning bodies, public works departments, traffic officials, safety associations, taxi, bus, truck, private car and tram organizations. It must be fully representative of the Island of Montreal. There is plenty of competent material with the skill and knowledge among our planning and traffic officials, and professional and business men, to act on such a Commission and to do things, provided they are given the necessary powers and financial backing.

2. We would recommend a PROVINCIAL TRAFFIC AUTHORITY under the direction of a Minister of Planning. The Province should assume a major responsibility in promoting community planning and aid financially in traffic undertakings in the Metropolitan area.

3. Surveys dealing with the volume of traffic should be supplemented with " origin and destination " surveys. Traffic surveys and studies should not be confined to any one section or locality. We must survey the entire network of streets and roads on the Island of Montreal and contiguous territory. The place of study is everywhere. All municipal authorities on the Island must join in the study of traffic and transportation.

4. We must have a personnel of traffic officers ade-

uate in numerical strength for enforcement and disciplinary purposes. If we accept the recommendations put forward by the Conference on Traffic and Safety sponsored by President Truman, the Montreal area alone should have 480 full time traffic officers. An enlarged traffic personnel would give relief now.

5. PARKING. One of the greatest aids to traffic improvement would be the provision of adequate parking facilities; either underground or on the surface; located not where there just happens to be space, but where it will meet the needs of the car owner for business purposes. An immediate improvement could be effected by the enactment of legislation requiring the owners of new buildings to provide parking space for tenants and employees, clients and visitors. Much could be done also to encourage the owners of existing buildings to rearrange their premises so as to provide parking space where feasible and practicable.

6. The adoption of a FINANCIAL RESPONSIBILITY LAW. One with teeth in it. We are the only province without such legislation. Such a law, in conjunction with modern arteries of travel and traffic enforcement, will help to reduce the number of accidents and lower the heavy premiums charged for automobile insurance.

7. Where are we going to get the money. Everybody is interested and obligated in some degree or other. The cost should be equitably distributed. However, insofar as motorists are concerned they are paying their way. Over $35,000,000 is paid in annually to the Provincial Treasury by way of gasoline taxes, registration fees, etc. It is our contention that a portion of the revenue so collected in the Metropolitan area should be returned for traffic improvements. A reasonable percentage would finance much of the cost of constructing expressways and of providing parking places.

At a recent highway conference which I attended, we were addressed by the Chairman of the Banking and Finance Committee of the United States Congress. In concluding his remarks he stated that unless we have production, more production and greater production, we cannot hope to solve our national and international economic difficulties. By the same token I would say that unless we have action, early action and immediate action in connection with our traffic problems, we will be faced with stagnation and heavy decentralization before we realize it — and who can say that transportation is not an important factor of production?

In conclusion, may I emphasize that transportation is a basic necessity for community development, and to this end our Club is doing its best to make our authorities and citizens alike realize the urgency of taking prompt action towards the physical improvements so much needed in our Metropolitan area.

W. H. Paterson, M.E.I.C.[5]

Mr. Williams spoke about a People's Plan. I would like to make a few comments on how we in Toronto endeavoured to make our rapid transit plan a people's plan.

In 1943 when we first actively undertook this project the community was not too enthusiastic about the idea. Subways are for large cities of over a million population. We knew at the time that it was going to take a lot of selling but our aim was not to get into any academic discussion at that time. We wanted to convince the people that it was a good thing for the community and have them support the plan.

Through the year 1943 there was considerable planning done and at the end of the year the plan was presented to the city, and there was a little press release on it but not too much publicity. In 1944 quite a bit more planning was done by the City Planning Board and at the end of that year, in conjunction with them, we put on a display in one of the large department stores. This was planned to go on for a period of about four weeks but to our agreeable surprise it continued for about eight weeks and I believe about 70,000 people came in to see this exhibit and learn what we were aiming to do. We had members of our staff there to answer questions and an enquiry desk where these questions could be recorded, so that we could find out what the people wanted to know and could continue to answer these questions in our talks which were given throughout the community.

We put an artist on our staff. This artist had a fulltime job making pictorial presentations of the structures which we were designing. These pictures were created; slides were made from them and members of our department and officials of the Company gave talks all around the town, until at the end of 1945 when a vote was taken on how the public felt about this project, they supported it by a ten to one majority.

I would like to bring this point home, that there is little doubt in my mind that planners, engineers, architects, can find the answer to most of our planning problems; the big job is to sell them to the public and to finance them, pay for them. Mr. Williams remarked on a sound financing policy and Mr. McNamee dwelt on this also. Our plans can be made practical only when they can be financed. In Ontario this year we have had some assistance from the Government, the Provincial Government, to communities, by way of a return of some of the gasoline tax. I believe when a fair proportion of the gasoline tax is returned, these plans will become practical.

[5]Engineer of Rapid Transit, Toronto Transportation Commission.

MEETING THE URBAN HIGHWAY CHALLENGE

B. D. TALLAMY
Chief Engineer, New York State Department of Public Works, Albany, N.Y.

An address delivered at the National Conference on Community Planning, sponsored jointly by the Community Planning Association of Canada and The Engineering Institute of Canada, Montreal, October 2nd, 1947

In 1941, practically 40,000 shiny new coffins were delivered in the United States to victims of motor accidents. One million hospital beds were occupied by other victims, while hundreds of thousands of others narrowly escaped similar fates.

Property losses are likewise staggering. According to the National Safety Council they amounted to $650,000,000 in 1945 in spite of rationed driving. Add to this the estimated $800,000,000 which insurance companies paid out in cases involving personal injury or death, the accident problem becomes a hydra-headed economic monster which feeds to a great extent in city streets.

Every one of us, regardless of race, color, or creed, or political affiliation, is seeking ways and means of halting this unnecessary frightening toll of life and property, but its solution does not lie in limiting the use of motor vehicles. Now our entire economy is utterly dependent upon them. The motor vehicle affects your morning cup of coffee, every meal, and everything you wear. There is hardly a single thing that any of us use at home or at business which, at some time or other during its development or delivery, is not completely dependent upon highway transportation. Food distribution would break down over night without the motor vehicle. Local transit facilities would be hopelessly smothered and our mills would grind to an instant stop should some cyclopean force halt motor transportation.

As a matter of fact, the motor industry itself and the allied businesses of sales, service and supply offer the greatest single business and industrial opportunity of employment to our people in New York.

Congestion a Main Hazard

Until rather recently, many of our business men wanted more and more traffic on our main streets in spite of growing congestion because that meant people and people meant business. But, like everything else in nature, moderation is of principal importance. Beyond a certain point congestion strangles the flow of traffic, resulting in degeneration of business, business property and tax values. Unless promptly halted, once such economical dry rot starts, it spreads perniciously to other sections of the city as a rotten apple affects a barrel of good ones, and with such serious consequences.

It is the challenge which has been laid down to the highway engineer by the urban arterial route problem which I hope to point out, together with how, in New York State, we believe that challenge may be met best.

During the same thirty-five year period that the motor vehicle and the inter-urban highways both were expanding at such unprecedented rates our cities too were growing like topsy. Unfortunately such growth was unplanned from the broad point of view and consequently mitigated against arterial highway construction in urban areas.

Nor were such unplanned spurts of city growth confined to the last 35 years.

Frequently at the very outset our cities were laid out to and grew according to a preconceived plan. But as the limits of this plan were approached, satellite developments sprang up. All too frequently these were completely unrelated to the nucleus community except possibly for one or two inter-urban highways which were previously established in the area. As a result, most of our modern communities have far too few through routes. Many that do exist are much too narrow, all are jammed with traffic and only an insignificant number may be widened effectively.

A practical solution to the problems which these conditions precipitate, is a part of the challenge which has been laid down to the highway engineer. The other and equally important part of the challenge is the creation of a system of arterial routes which will not only carry interurban highway traffic to and from its destination and origin in urban areas but which will at the same time stimulate healthy city growth.

Development of Arteries Highly Important

A city is really a living thing. It is constantly changing. It is always growing and deteriorating. The balance between the two determines whether it is a static or a healthy growing community. Like every living being, its vitality depends upon its circulatory system. Shrunken, congested arteries mean stagnation and creeping paralysis. Efficient, free-flowing arteries mean vigor and health. The development of a system of arteries, therefore, which will stimulate city growth properly is the second part of the new challenge laid down to the highway engineer by the urban arterial programme.

There is much more to developing a city arterial route than blasting a new highway through the city to serve through traffic. Such a procedure might likely do more damage than good by disrupting the proper functioning of various sections of the city, thereby accelerating blight of public and private properties.

It might stimulate development in a section which should not be developed at present because of improper foundation or drainage conditions or where the cost to the city for furnishing utilities would be excessive as compared with another section which might serve equally well for a through route. It might raise havoc by discharging too large a volume of traffic from the new route onto a city street system totally unable to absorb it.

Before the highway engineer can proceed with the development of a system of arterial routes, he must know what makes the central city and all of the suburban areas tick. He must be fully cognizant of the financial condition of the local communities and the state so that he can design a system which will not only meet all those other factors but which will be financially practical as well.

In New York State we believe the best way of meeting this challenge is by first preparing a master plan of state arterial route development for each urban area of the state.

This plan is based upon all of the factual data relating to the community and its environs that may be secured. It is planned to meet future as well as present traffic requirements and to be capable of expanding still further in the future as conditions warrant.

Upon completion, the plan is submitted to the local officials for their consideration and approval, after which the legislature with the approval of the Governor is requested to place the various routes set forth in the plan upon the state system of highways.

Following that, the Department of Public Works selects projects from the master plan for construction, in accordance with their individual need and available financing, confident that each is a part of a carefully-thought-out whole plan which when constructed will redound to the best interest of the city as well as of the state.

Should the city officials disagree about the need for or wisdom of a portion of the plan, round-table discussions are held to adjust differences of opinion and to amend the plan so that all agree it is to the best interest of all concerned.

Local approvals have been expedited by submitting to the local officials at the time of presenting the master plan, all of the basic material upon which it is predicated, together with a report on the line of reasoning followed by the department in its interpretation of this material.

New York State Action

In 1945, the technique of urban arterial route planning was strange to our Department. The legislature on the recommendation of the governor had authorized the Department for the first time in its history to plan and to construct, as funds are made available, a state system of urban arterial routes for each city in the state.

This action was taken in recognition of the ever increasing volume of inter-urban and regional state traffic which either originates within, terminates or flows through, those metropolitan sections. Between 80 and 85 per cent of the traffic on our state highway system in those areas is of that character. Maintaining and expanding the facilities necessary to support that traffic within cities has become, or is rapidly becoming, an impossible burden to the city tax payer.

Consequently the Arterial Route legislation was passed in order to lift most of the load resulting from state traffic from his shoulders and at the same time enable him to secure the indirect benefits which spring from the creation of a fully adequate arterial system and which are almost always of parallel importance. That and the comparable federal legislation we feel were master strides forward in highway progress.

In New York State there are 61 cities having a population of more than 5,000. Actually, they and their suburban areas vary in size from about 10,000 persons to over a million, exclusive of New York City. Some are commercial communities, some principally industrial, others primarily residential sections.

The development of master plans of arterial routes for these alone is a herculean task, for only in New York City itself had the planning of such routes advanced to such a stage that both the state and the local officials could agree as to the appropriateness of the proposed system and to adopt the local master plan without prolonged study.

In the other metropolitan sections, however, complete arterial route studies had to be made. There, local planning emphasis had been directed at other objectives. In most of the smaller cities no local planning of any sort had been undertaken. Frequently they were "unzoned".

To make the problem still more difficult, the historic training of our Department's designing staff had been directed toward the development of primary inter-urban state highways and routes of lesser importance. City arterial route planning, and even construction, was a new field to them.

Route Planning Bureaus Created

In order to overcome this difficulty, a Bureau of Arterial Route Planning was created in the Department. This was designed to act as a consulting agency to work with our district engineers and their staffs.

The Bureau organization includes a director of arterial route planning. This position is directly responsible to the chief engineer. He is also responsible for the functioning of the Bureau. He has three principal engineers in charge of planning, to assist him. They in turn have a complete complement of men who are specialists in various fields such as traffic and planning, design and valuation.

Within the Bureau there is also a group especially trained in developing art renderings and popular ways of presenting the statistical and other basic material upon which the plan is based.

The real work, however, is done in the District Offices. The district engineer is responsible for the preparation of the master plan for collecting and preparing of all of the basic material. The Bureau merely consults with the district engineer and his men. It advises them of the latest developments in other districts. It is particularly valuable in presenting a completely detached unprejudiced point of view.

In the event of disagreement between the district engineer and the Bureau, an interim statement or report is submitted to the chief engineer for a decision on the point in question.

When the plan is completed but before the final report is prepared for submission to the local officials for their review, a final inspection of the plan is made by the superintendent of the Department and his entire staff of advisers.

This procedure has been successful in New York. Since 1945, final reports have been submitted to Buffalo, Dunkirk, Rochester, Syracuse and Rome. The first two have been approved and actual construction is under way in Dunkirk. Bids will be received at an early date for a major project in Buffalo, and others will follow in the near future.

Approval of the other plans which were submitted to the local authorities only last week, are expected this fall. When they are, actual construction will be promptly undertaken.

Basis of Surveys

Plans for five other cities will be ready for local presentation in October, and several others in November. The Department has 19 master plans of city arterial routes now on the draughting boards, and 48 city traffic surveys have been completed since 1945.

These, consist of volume counts at critical points of major street systems and origin and destination surveys of both passenger vehicles and trucks. Parking practice, time and delay studies on congested major highways, and studies of special intersections and areas are also made.

The twelve-hour traffic census, normally conducted between 7 a.m. and 7 p.m. follows a standard procedure for this type of survey.

Vehicle volumes in each direction are recorded for each hour of the survey.

At key intersections and points of obvious congestion, the number of right and left turning movements, on every street entering the intersections, is also recorded for each hour. Vehicle volumes are recorded separately by type.

The return postal card method is used for the Origin and Destination surveys, with the exception of those conducted in smaller cities. There, the interview method is used. In the card survey, a series of questions are printed on government postal cards inquiring as to the place where the trip began, where it ended, route followed, major intersections passed, type of vehicle, purpose of trip, and method of parking. The time of day and the station at which the cards is to be passed out, are indicated previously on the card by members of the survey staff.

Experience has shown that the bulk of the returned Origin and Destination cards are received in about two weeks. Returns have been as high as 57 per cent. They are coded by the district office survey staff and analyzed by making use of electrical accounting machine equipment.

The total cost of these surveys, including mechanical tabulation, averaged about 5 cents per capita.

In addition to this traffic work, the development of a major thoroughfare system must, of necessity, take into account present and future population distribution. The studies must consider the trends of decentralization, the growth of the outlying suburban areas and their importance.

Other Material Factors

Other factors materially influencing the plan are increases in motor vehicle registration, use and their probable future distribution in the urban area, potential expansion or decentralization of the central business district, and any contemplated industrial or commercial development.

Our urban plans contemplate the fullest use of existing street system where the physical conditions of right of way, grade, alignment and location fit into the required pattern.

In some instances, it has been possible to create added capacity, where existing street widths permit, by materially widening the pavement and developing the route on the super block principal, eliminating some intersecting streets and by controlling traffic movements at others so as to permit right-hand turns only. Such elimination of marginal hazards and friction along arterial routes to the greatest extent has been found to be of the utmost of importance.

In other cases, the development of parallel one-way streets, particularly where they are actually transformed into new thoroughfares by cutting through blocks and joining existing, though noncontinuous streets, has proven successful.

Where these methods are unpractical, arterial routes on new locations are studied. In many cases these involve the need for right of way through built-up areas. Where the anticipated volumes warrant, our plans provide for an express type of highway with grade separations and complete traffic interchanges.

Due regard has been given to the importance of parking facilities at the termini of the arterial routes leading into the central district and other congested areas.

Parking a Problem

Parking of motor vehicles is a problem which affects every citizen of the community. The merchant is interested in his sales volume, the owner is interested in the stability of his property value. The shopper is concerned with the ease and convenience of making his purchase and the downtown employee is desirous of having a convenient place to park his personal means of transportation.

At present, the solution to this perplexing problem seems to rest primarily with local enterprise, with local government providing an official leadership. The responsibility of the state is limited to the stimulation of local action and the provision of enabling legislation where needed.

The Urban Area Reports emphasize the importance of this problem, and point out that the full benefit of the arterial routes proposed, cannot be derived from their construction until some adequate solution to the parking problem is likewise undertaken.

Master plans have been prepared to meet anticipated traffic requirements fifteen years after the date of the traffic survey. This period was chosen because it was believed to be about maximum period for which a reasonably accurate forecast with so many influencing factors could be made. In addition, it seemed to fit into a reasonable financial programme.

In New York, the state meets the entire cost of construction, and one-half the cost of right of way. The only cost to the local government is for the other half of the right of way.

With continued Federal aid for urban highway construction, and with a reasonable anticipated state programme, it seemed that most of the arterial plans could be completed well within that fifteen-year interval. That being the case, the entire system could be constructed in sufficient time to observe its performance and other factors before advancing another plan for supplementing and extending the system, if required.

We believe that by following these general principle we may successfully meet the urban arterial route challenge now confronting us in New York.

Construction of these systems will revitalize the arteries of our urban centers upon which we are all dependent. Blighted areas resulting from traffic congestion should largely disappear. Decentralization of required central business areas halted, and city property values maintained or improved. When completed, traffic will not have to dodge and twist and worm its way through a maze of city streets. Time of travel between home and work will be materially cut down, commerce expedited, safety increased.

Confidence in our urban areas will be restored. A new burst of opportunity should be created for all.

STANDARDS OF PLANNING OF NEW NEIGHBOURHOODS

C. A. MEADOWS, M.E.I.C.
General Manager, Meadows, Citoph & Co., Consulting Engineers, Toronto, Ont.

An address delivered at the National Conference on Community Planning, sponsored jointly by the Community Planning Association of Canada and The Engineering Institute of Canada, Montreal, October 3rd, 1947

The author relates existing standards to the various phases of community planning, such as the determination of type, location and size of neighbourhood, and relates tenant income to size of lots. Population densities for various cities, ancient and modern, are given. The planning of schools and other community buildings, as well as streets, roads, and services, are discussed, as well as other considerations that affect the layout of a community.

All of the important facets of our lives are measured and controlled by standards, which determine as well the design of the physical things we have and use, and which make possible the duplication of the items that find public favour, with reasonable facsimile. We have exact standards of weight and measurement, temperature, speed etc., in fact almost everything except the length of a lady's skirt, that apparently being too temperamental an object to standardize.

In turning to the task of setting down some standards of planning of new neighbourhoods, it is interesting to let one's imagination go back one hundred or so years, to a time when engineers were also setting for themselves standards for what were then new neighbourhoods. I think we should not be too critical of the results of their work as we see them today hampering our present way of life. Rather we should be impressed by their lack of foresight, and see that our planning is done with two eyes to the future and one to the present.

I am convinced that in the field of community planning in Canada there is an urgent need for a book of standards for planning. The composition of such a volume should be undertaken at once by The Engineering Institute of Canada, and made available to all those engaged in the planning of our communities.

In the meantime, it is hoped that the material put forward in this paper and in the discussion following will prove of help to those who are called upon to formulate and make decisions regarding the proportioning of our new neighbourhoods. So much for standards.

According to my dictionary a neighbourhood is a district or a vicinity. Most of them today are aggregations of neighbours, so inconvenient and ugly that they ought to have hoods over them to keep them out of sight. Probably that is why they are called neighbourhoods. In order to clarify our thinking on this subject, I propose to set down, in an approximate order of importance, some definite subjects and tie to each some suggested standards.

Determination of Type, Location and Size of Neighbourhood

Fortunately many of our cities are filled up, and for new population it is imperative to establish new communities. In so doing, planners should have the idea of a well balanced neighbourhood constantly in mind. Housing, employment, shopping, schooling, worship, recreation, traffic, and services, all should be carefully weighed and provided for, to give a well proportioned and balanced neighbourhood. And of course it should be generally understood that the purpose of the new neighbourhood will determine type, location, size, etc.

The Type: Is it entirely for factory or mill workers; is it for government employees; for professional people and those engaged in commerce; or is it for a mixed urban population? A determination of the type of occupants will have a great deal to do with the location.

The Location: It is a good thing for employees to be able to walk to work and come home for lunch—that is if the wife is an agreeable sort of person at lunch time? If the source of employment is a factory, the residential neighbourhood should be located to windward of the plant with respect to the prevailing winds. Relatively high locations should be chosen with respect to proper sewage and drainage. Generally speaking, areas at river mouths and subject to recurring floods had better be left to frogs and fishes than to human beings. Of course if that were done the newspapers would not be able to publish each spring photographs of heroes pushing through 2 or 3 ft. of swirling water carrying babies to high ground, but it would be distinctly more comfortable for householders.

The Size: Once the location is decided upon with respect to the type, the size of the neighbourhood should be calculated and defined. But the overall size of the whole will depend upon the size and number of the component lots, roads, and the properties required for accommodating the public services.

Therefore one must ascertain at this time the income bracket of the inhabitants.

The Income Bracket

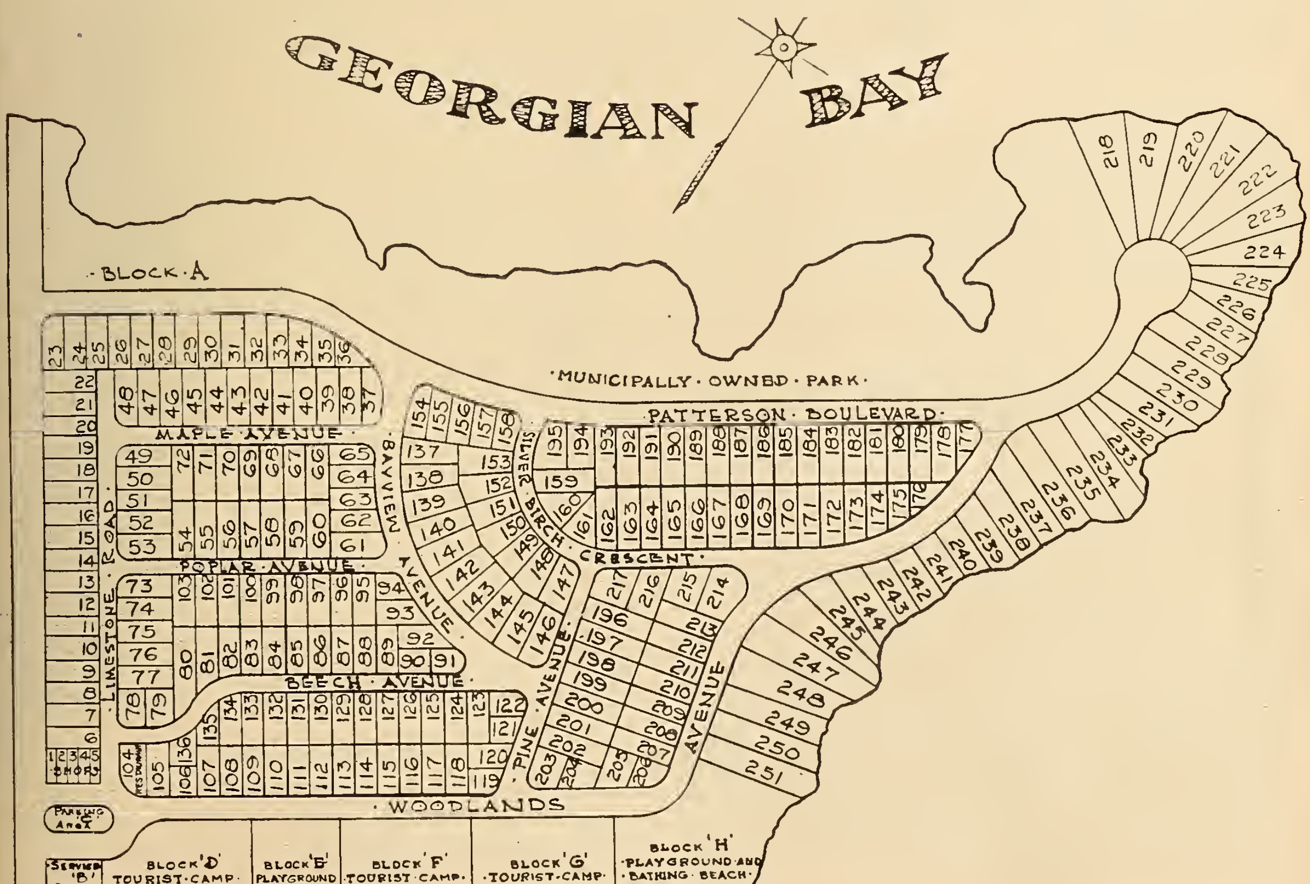
The best way to prevent the formation of slums is to give people shelter they can pay for out of income, without encroaching upon income that should be used for other requirements. Therefore te size of the lot, the size and character of the neighbourhood, the class of the municipal improvements and the location of the neighbourhood should combine to provide good shelter that comes within the reach of their incomes. The lot areas suggested by the Department of Planning, Ontario, are very good: viz., 5000 sq. ft. where served with piped water and sewer; 7500 sq. ft. where safe water is available other than from wells on the property; and 12000 sq. ft. where well and septic tank are necessary.

The width of the lot should be determined having in mind a healthy distance between houses. The wider the lot the greater will be the annual cost of local improvements, the more snow to shovel and the greater the distance to run to the bus on those mornings you rise late. Fifty feet is a good minimum width to suit the factors just named, and in areas of exceptionally high cost land, a narrower width may be tolerated. It is doubtful however if many totally new neighbourhoods will be located on lands so high in cost as to require narrow lots. Excessively large lots place too

A COMPARISON

Above: Paradise Point, a section north of Port McNicoll, Ont., as formerly planned in accordance with conventional gridiron pattern.

Below: A revised plan of same section which provides for municipally owned water front and many other advantages. This revision took into consideration the rise and fall of the land. (See also front cover picture.) Illustrations courtesy Meadows, Critoph & Co.



great a burden upon the owner to keep them up nicely. A smaller parcel well kept is better than a large lot overrun with weeds and rubbish.

Density of Population

This is calculated as gross density, that is, the divisor of the total population of the neighbourhood by its total area; and as net density, that is, the divisor of the total population of a block or section, exclusive of streets etc. by its area. Both figures are useful in proportioning a new neighbourhood. The following examples of gross density of population are interesting for reference:

	Persons per acre
Ancient Rome	240
Ancient Athens	250
Manhattan (1940)	134
New York City	39
Chicago	26

		Persons per acre
In one census area of	New York City	450
In five census areas of	New York City	250
In three census areas of	Boston	450
In seven census areas of	Boston	250
In two census areas of	Philadelphia	150
	Toronto	20
	Oshawa	7.5
	Belleville	10

The following examples of net density are interesting:

	Population	*Net Density*
Knoxville, Tenn.	100,201	28.1
Vancouver, B.C.	143,560	61.7
Forth Worth, Tex.	152,730	29.2
Average density		38.4

Population density rates very careful study by the planner, because on it depends many major factors such as cost of roads, sewers, water supply and transportation. One must balance the lower population densities against the necessary costs of low density, and one must also consider the general location of the new neighbourhood and the character of the occupants.

Types of Residences

These should be determined after learning the nature of the inhabitants. Some people like single family homes; some like duplexes; some like apartments. Some people can afford large homes, some people have a struggle to maintain a small home.

Sometimes it is possible to canvas the people who will occupy a new neighbourhood and thus obtain some pretty good design data. The city of Belleville is doing something along that line at the present time. In two major subdivisions of that City we are providing a section for working-men's homes close to the industrial areas, and we are providing for more expensive homes in other sections. The two different sections are separated inoffensively by the school area and shopping area in one case and by a wide boulevard and green belt in the other case. The factory workers living in the lower priced homes will be able to walk to work and their womenfolk will be able to walk to the shopping districts.

Schools, Playgrounds and Churches

The provision of land for such institutions requires careful study and calculation. The different provinces have their own ideas of the land that should be provided for lower and upper schools. I have not been able to obtain any standards up to the present time, but I believe some of the provinces are compiling certain standards for distribution. *Pro tem* the following acreages should, I think be considered as a minimum:

	Acres	*Optimum number of pupils*
Kindergarten School	1½	125
Primary School	5	450
Secondary School	10	1350

The provision of schools for the various age groups in the neighbourhood is calculated from the population data assembled by the planner. Bulletin No. 5 compiled by John Galbraith, M.E.I.C., former Director of the Community Planning Division of the Dominion Government, will be found of great use to the planner in making his calculations.

Average figures for the Province of Ontario show:

	Percentage of Total Population in the Age Group	
Age Group	*Rural*	*Urban*
1 — 5	9.23	7.42
6 — 10	9.29	7.70
11 — 13	5.66	4.94
14 — 20	12.57	12.1

Example: Say a neighbourhood includes 500 single family homes, i.e. a total population of say 200 people:

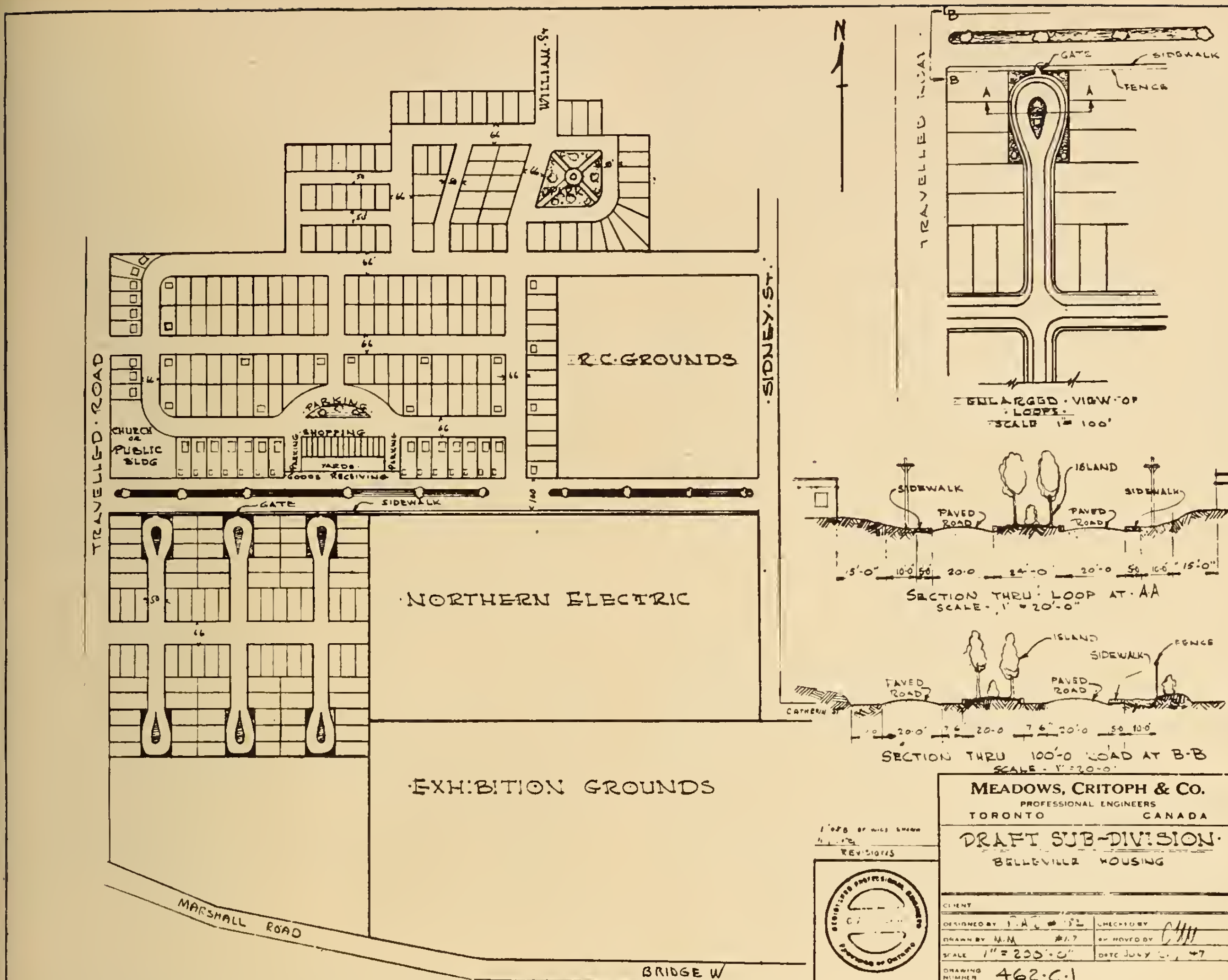
Public School Pupils	7.70	
	4.94	
	12.64%	= 250—about ½ of a School
High School Pupils..	12.1 %	= 240—about 1/5 of a High School

The requirements and customs of each province should be studied of course by the planner when he is analyzing the schooling for the neighbourhood. Playground facilities should be studied having in mind the needs of small children, of larger boys and girls, and also of adults. If large playgrounds are located in the older part of the community but close to the new neighbourhood, it is possible that the new neighbourhood will be adequately enough served by the present playground.

It is unlikely that children will ever be persuaded to forsake the streets for play. The provision of numerous small playgrounds for small children is being experimented with, but it is my opinion that if the neighbourhood is designed to keep fast moving dangerous traffic off streets upon which houses front, more satisfactory conditions for the play of small children will obtain. I feel that any standards to provide for this part of planning should be developed in conjunction with organizations of parents and the directors of recreation.

Streets and Roads

Residential streets should not be less than 50 ft. wide, and in most cases wider. The streets should generally be proportioned to the use. The wholesale use of the surveyors chain (66 ft.) irrespective of the re-



A proposed residential-manufacturing section. Note how easy access is provided to the plant. For further information see page 530 of text.

quirement, should be abandoned. It results in a waste of land in some instances and in congestion in other instances. Generally speaking, residential streets should be wide and should be provided with shade trees. If the sidewalks are laid immediately adjacent to the roadway, it is possible to snow-plow both at one pass of the plow, providing all poles, hydrants etc., are placed inside the sidewalk. Shopping streets should be comparatively narrow and should be provided with large storm sewers underneath to receive the snow in the winter time. All electric wires should be underground, and if possible streets should be arranged for one-way vehicular traffic. Through traffic should be accommodated on other streets. The use of a shopping street for through traffic is fatal and should not be tolerated. If those two conditions are met, shoppers may be allowed to park opposite shops for a limited time. Provision should be made for unloading and loading at the rear of shops by means of one-way service lanes. It is better to set up a shopping centre within the neighbourhood than to have strings of shops.

Main streets should be wide, with traffic dividing-strips down the middle. Main streets should surround the neighbourhood and should never pierce it. There should be a limited number of exits and entrances from the neighbourhood to these main streets, and if possible no houses should *front* on these main thoroughfares.

Other Things to Consider

The ordinary town planner will, I feel, be well advised to call in engineers who specialize in the design and supervision of sewers, water supply, electric supply, and central heating services and who work to well-known standards.

Planners should not lose sight of the probable need for providing for the private airfield and for helicopter landing spaces. Personally I do not feel qualified to prophesy what the future will require, but I urge the study of this matter and the inclusion of standards for same in a compilation.

Set back of buildings from the street line merits attention. On residential streets 20 ft. is a good figure to use, which results in approximately 100 ft. between buildings. On shopping streets no setback is necessary.

Parking is a problem in those cities where for the most part all business is concentrated in one portion and all residences in another, and where shopping streets and main traffic streets are one and the same. Parking need be no problem in a new neighbourhood if it is properly designed. Parking is simply one load the neighbourhood has to bear, and is distributed and concentrated in various sectors. Engineers know how to design structures to bear the design loads, and they can design neighbourhoods to carry the parking loads too.

A lot of study should be done on the subject of "investment per person". If the neighbourhood is designed to place a taxation load on its inhabitants that is unbearable, it will go bankrupt and its bondholders will lose their investment. It should be possible to assemble some figures that will show planners and municipal government the limits of investment in services and housing that their citizens may carry safely.

Land assembly is something comparatively new, and is a Dominion government sponsored plan whereby life insurance companies are permitted and encouraged to purchase land, and to finance the installation of water, sewers and roads so as to provide serviced buildings lots. The price of the lot includes the cost of the services, and is amortised along with the price of the house. The development of the land is not a charge on the municipality. Presumably the insurance companies will be astute enough not to become overextended, as was the case with many municipalities in former years.

From this point the speaker used slides to amplify his descriptions. Unfortunately all the illustrations used are not available.—Editor.

The first slide shows a development, more or less a theoretical design of the neighbourhood along what people call the line of the gridiron. In this picture you will find that there are 137 right angle intersections of streets. There are 64 entrances into the main encircling street. In other words, we have 137 excellent chances for intersection accidents and 64 excellent interferences with express traffic which travels on the main road.

A second illustration shows the same area laid out in a different pattern. In this picture you will find 29 right angle intersections compared with 137, and you have 21 entrances to main streets compared to 64 in the old plan. This is a pictorial lesson in the advances that we have made in the division of land for use by people from the old-fashioned checkerboard idea.

The next illustration shows something a little more practical. (See illustrations on page 527). This is the Paradise Point resort subdivision which borders on Georgian Bay north of Port McNicoll. About 20 years ago it was laid out in this fashion and you can see that it could be improved. No matter how desirable it was for a budding city of those days, it is far from our ideas of a summer resort today. The lots are 35 feet wide, 95 feet deep, nice garbage lanes in behind. The east and west streets terminate in the waterfront, as do the north and south streets. The layout was made without much respect to the rise and fall of the land. In this case we discarded the right-angle streets and made what could be called a circulating boulevard or road, which originates from the shopping center or service center in the lower left hand corner, and follows the contour or shape of the waterfront. We combined the sum total of the road ends that you observed in the previous picture and produced quite a substantial municipally owned waterfront.

The next slide shows another layout that we have suggested for a neighbourhood. (See illustration on page 529). We do not have to provide for a school here, because there is a large school just beyond the area shown. Where you see "Northern Electric", is the site for a large plant now being erected, we are proposing to work in those houses in the left hand section, and a wide boulevard, and two lanes north of the Northern Electric plant, which will be serviced by the commercial road shown in the centre of the illustration. This is the first step toward providing something for accommodating automobiles.

DISCUSSION

Carl Klotz, M.E.I.C.[1]

Mr. Meadows drew attention to the difficulty of standardizing on ladies' skirt lengths, but the planner there will recognize certain basic trends, and variations in these trends are necessary to take into account local conditions such as a perfectly delightful vista on the one hand, or an overcrowded condition on the other. But the designs cannot be reduced to rules or standards. Often a poor or hasty design is soon obsolete, blighted, then vacated at considerable loss.

In planning cities, towns, neighbourhoods or rural areas there are many phases of the planning where standards of good practice should be developed or sought out and applied. There are other phases where experience and intimate knowledge of basic trends and local conditions must guide, rather than standards. Standardizing can become rigidizing if carried too far. Gridiron street systems and chain-wide thoroughfares are instances of such rigidizing.

Mr. Meadows believes that we should have a book of standards, and I agree. I think we should have some basic guiding standards consolidated under one cover. The National Research Council has already published The National Building Code, a Model Zoning By-Law and a Standard Plumbing By-Law. Under the Council's recently formed Division of Building Research, such a book of planning standards could be prepared with the E.I.C., the Royal Architectural Institute of Canada, the Community Planning Association of Canada, and other nation-wide organizations participating.

There are several different kinds of standards. You have ideal standards; then you have what I would like to call investment standards or "good practice standards". Then there are the minimum standards, by which I mean minimum commensurate with public health, safety and welfare. In other words, we are getting into the field of by-laws based under police power, such as building by-laws and zoning or land-use ordinances. Such by-laws are, to my way of thinking, bordering on illegality. It is almost impossible to agree upon aesthetic standards, but grossly unaesthetic construction or developments, it can well be argued, do involve the public interests sufficiently to warrant some legal minimum standards, or restrictions.

Project planning versus community planning introduces some differences, as where a new neighbourhood is to be built in its entirety at once. The planner's work is simplified inasmuch as he crystallizes its future himself. Even then some legal standards are necessary to protect that future. However, if the planner has the task of moulding a neighbourhood, community or city into a form to be developed over a considerable future period, with many individuals par-

(1) Aluminum Company of Canada, Montreal. Spoke at the request of the E.I.C.

ticipating in that growth, then his task is more difficult. In both cases his preliminary studies must take into account the future, but in the latter case he is confronted with the double need for good investment standards to govern his design of the skeleton and good minimum standards or by-law standards to guide the growth of flesh on the skeleton. These by-law standards usually take the form of a building by-law and a land-use or zoning by-law. A third type of municipal by-law or regulatory measure not yet commonly found is a by-law controlling the subdivision or re-subdivision of land.

There are today a good many standards available in the field of building and zoning by-laws and the planner should be familiar with these standards and be able to adapt them to his work. Basic standards must be adapted to local characteristics and requirements and the adaptation must be sufficiently flexible to permit wise future revisions.

There are various aspects of planning. Community planning involves not only physical aspects but also social, economic, financial and legal aspects. It would seem possible to devise standards of attack, standard procedures for making the preliminary studies so essential to the ultimate plan of the growth and development of the community or neighbourhood. They will vary, of course, particularly in the case of planning new communities; nevertheless standards of procedure are possible. For example, standards of procedure for making population studies appear feasible so that population growth, composition, occupation, wealth and future trends are known. Standard procedures for making land-use surveys are possible. Standard procedures for making traffic and parking surveys are not only possible but fairly well established.

Perhaps our prime interest at the moment is with physical aspects. Mr. Meadows has wisely drawn attention to the need for balance or proper proportioning of various land uses, such as residential, business, industrial, traffic and transportation, recreational. Standards here would seem most difficult. For instance, it is most difficult to establish the optimum relation between residential and business uses. Few such studies are available as guides. Rachel Caro, in *The Architects' Journal* of April 1945 reports such studies. *The Architectural Forum* of October 1943 published data on neighbourhood shopping requirements, and Hugh Potter in the same article suggests one foot of local business frontage for each fifty people. Incidentally, Potter also recommended three square feet of off-street parking area per square foot of shopping area, and also recommended both front and rear parking, which means front and rear entrances.

The optimum size of a neighbourhood is now commonly accepted as that served by an elementary school of optimum size, but there is no real agreement on this school size. Mr. Meadows suggests 450 pupils. United States educational authorities recommend 1,000 to 1,200 pupils as an economical size. I believe Mr. Meadows' figure is closer to right for most Canadian municipalities. The planner's population studies will here guide him as to the probable number of families or dwelling units that will contribute to the elementary school age group.

The street system and subdivision scheme for any neighbourhood certainly lends itself to guidance by basic standards. Mr. Meadows has mentioned that a minimum street width of 50 ft. between property lines is reasonable. Where traffic flow estimates are sensible the paved widths can be adjusted to suit the estimated flow. Standards of traffic capacity per lane are available, though still open to argument by experts. Residential lot sizes are gradually becoming standardized, and it has been pointed out that the 5,000 sq. ft. lot is generally regarded as a minimum, with 50 ft. as a minimum width. Standards governing the minimum and maximum sizes of blocks for various types of land-use can also be set forth and this in effect governs the amount of land in streets.

Subdivision regulations beyond corporate limits are another phase of the problem. Many of the standards for the street system and the lot subdivision can be set forth in municipal subdivision regulations, but the legal ability of a municipality to enforce such subdivision regulations beyond its corporate limits is an urgent necessity, even in the case of relatively small towns. This is in order to protect the town from peripheral shack developments and resultant increase in fire, police and social service costs and decreases in land values. The municipality should have something to say about how the land around it is to be used.

In concluding my remarks I would like to point to the real necessity for procedural standards in making the preliminary maps, studies and assumptions necessary for neighbourhood of community planning. I would like to suggest that zoning ordinances, building by-laws and subdivision regulations comprise tools with which the planner cannot dispense, tools that in effect constitute a broad group of standards on which much development work has been accomplished. The conscientious planner will wish to see his work protected by such municipal enactments. There is a good deal of information available today, and we urge community planners to combat foul fringe growths which spring up about otherwise well-planned neighbourhoods.

P. Alan Deacon[2]

There has been a great deal of discussion about the need for standards. Mr. Meadows has recommended a handbook. I am inclined to agree, to a point, that we need certain standards in the planning field, but I think we do not want a rigid framework of standards. If those standards can be expressed in terms of the most desirable standards for a neighbourhood, I am all for them. There are certain standards of health and safety which must be our arbiter.

There are other standards which will devolve on the community itself, and I make a plea for the approach of the planner to be a more social one than a technical one. After all, a neighbourhood is a collection of people. If we are going to plan, let us plan not only for those people but with them. The people themselves have, I believe, a great deal to contribute to the work of the professional planner, and my plea is this, that we technical people who are engaged in the planning field do not forget that in order for our plans to be effective they must be produced with the full support of the people for whom we are planning.

Mention was made of desired lot widths, and there is a certain standard in Ontario, as Mr. Meadows told you, and it was set up by the Department of Health. A minimum building lot is 50 feet. One of the dangers one can run into in this arbitrary setting forth of standards is perhaps exemplified in the mix-up we had

(2) Architect, Toronto, Ont. Spoke at the request of the C.P.A.C.

at North York. A plan was submitted and was approved by the Central Mortgage & Housing Corporation, and on the whole it was not a bad plan of subdivision. It could have been better but within the limits set by the property it was not too bad.

In scanning it over before making a recommendation to the Planning Board one significant feature came up, the lots were 42 feet wide. That is not an unreasonable width for a lot, but it struck us as a curious selection of a width. There was a lot of waste space at one end, thrown into a sort of park area. When the subdivider appeared before the Planning Board he was asked: "Would you mind telling us how you arrived at the 42 feet width?" He said: "It is perfectly simple. The National Housing Act demands a minimum of six feet on each side of the house. My houses are 30 feet wide; therefore my lot width is 42 feet." That is what happens when you have a rigidity of standards. There was no imagination. He was a very practical builder and was trying to get the utmost out of his property, the greatest possible number of houses on the land available, and not waste any land; yet he was following standards.

I think there is a great deal more to planning than following standards. One has to use his imagination. We heard yesterday that the profession of planning cannot be limited to any one profession. Certainly it should not be. It is a definitely cooperative effort and I make a plea here, that in thinking of terms of standards that we enlist the sympathy of the people and the active participation of the people for whom we are doing the planning, to help us professionally determine those standards.

A. E. K. Bunnell(3)

May I correct an observation of Mr. Deacon's? We have no standards in the Province of Ontario. We do have certain things that we call yard-sticks but there is nothing fixed.

Robert Fairfield, Jr.E.I.C.(4)

I don't propose to take up the cudgels on behalf of standards, or even of yard-sticks. I am impressed however with the fact that our standards heretofore have possibly produced the conditions which we are here today to discuss, by way of trying to find some way of improving these conditions. I think it might be more correct to say that if these things are thought out and, as Mr. Deacon has suggested, thought out on a community level for each particular problem, we might arrive at the most desirable local plan; but to try to impose standards on the entire question I think is going a little too far.

We are concerned now with the supervision of a neighbourhood of some 660 houses, and at this time I would draw the red herring of housing across the discussion again by saying that the chief obstacle in our way towards a successful completion of this neighbourhood, is the cost of the houses. It is almost impossible for people to acquire the accommodation they need in this community at the prevailing cost and using the prevailing method of construction.

I think if we are going to talk of new neighbourhoods we have to talk of some solution of the question of providing these neighbourhoods with homes that people can pay for; otherwise we are going to have a lot of inadequate, temporary or obsolete homes.

I did not intend to raise the question of prefabrication, but it may be of interest to you to know that there is a prefabrication company in the United States which tooled up sufficient factories all over the United States to provide 20,000 or 25,000 units a year. That is approximately half the house production being turned out in Canada by the entire construction industry. They also tooled up for the construction of all the new theatres in the last four years at a cost of $5 millions.

Being an architect I am not going into the question of how to get the $5 millions; that is something of a problem. I do say however that the question is quite reasonable and there is no reason why it cannot be done in this country.

E. G. Faludi(5)

While we are discussing standards, all over the country at this very moment the same agencies which require these standards are doing their best to overhaul the minimum standard. At this moment all our public agencies are not doing what they should do when we are trying to improve the living conditions in the urban areas, when we are trying to develop new neighbourhoods which would satisfy the minimum requirements for living conditions.

I would start with Wartime Housing. These remarks are not directed against the present organization of Wartime Housing. I am sure its present administration will do its best, because it wants to save what can be saved by the establishment of certain standards. During the war we built wartime houses all over the country and we placed them with no requirements or conditions, no yard-sticks, all around the cities. We infested the cities with wartime houses. They were temporary structures; some of them were good structures.

Agreements were made that six years after the war these houses would be demolished, and now they are trying to make an agreement to perpetuate the temporary houses. The perpetuation of the temporary house means the opposite of what they have done. They have really created community spirit in the wartime housing; they have provided a community center; they have provided the social amenities required for good living conditions and good neighbourhoods; and now after creating them they destroy them by handing over certain numbers of houses to the individual. Thus they will dissolve the good and well-organized communities, which could be good channels for providing standards.

I accuse Housing Enterprises Limited. They had placed residences in, let us say, a so-called neighbourhood; they are more or less only subdivisions with no relation to the total development of the city, with no streets, schools or social amenities, etc. I accuse the insurance companies which at this very moment are developing subdivisions all over the country in fringe areas. They are not developing them along the lines of the principles which we are advocating as professional planners.

I accuse many cities of not doing what they should to try and solve their local problems, which they could do by following the principles and the paths which their own Planning Boards are advocating. I don't

(3) Ontario Department of Planning and Development.

(4) Partner, Murray & Fairfield, Architects, Toronto. Member C.P.A.C. and E.I.C.

(5) Managing Director, Town Planning Consultants Limited. Toronto. Spoke at the request of C.P.A.C.

want to mention individual cities, but there is a good example in one large city of Canada where they want to take away from the residential area minimum standard requirements in the form of parks, because another agency wants to over-rule their principles and they want to go ahead with their own job which has no relationship to the rest of the development of the city.

We are here to learn something practical. With Utopias we will never develop anything. We can however, develop with certain principles which we will carry out. We will try to carry them out through the same agencies that have the power to do it. Fortunately the present organization of Central Mortgage & Housing Corporation and also of Wartime Housing realize what those ideals are which they have to pursue. There is still time in the further development of our urban centers, and with their cooperation, for us to build neighbourhoods which will follow the major principles which we are advocating.

The Government, in the National Housing Act, I think Part II, provided $5 millions for education on housing research and community planning. There is as yet nothing very much done in this field. I know about the research on housing, but nothing has been done on community planning. We have not even a four-page booklet which would educate the various agencies on what is town planning or what are the ideals and objectives. Most of the agencies are confused because there are sources advocating neighbourhood development and they hear about it from the Dominion Government, the Provincial Government and perhaps a private consultant, and each of these has a different point of view, different standards. The result is that municipalities are worried about town planning, and some of them don't believe in it because of the confusion created by so many "directives". Sometimes they are able to do only what their own sewer and sidewalk developments enable them to do, leaving out all the fancy ideas about planning for better living conditions.

It is extremely difficult to advocate standards when we professional people and the agencies that have to work in this field cannot agree. Everybody says we need standards. Before the same table two persons deny the same standards which another advocated.

The various schools of thought in the United States and Great Britain already have established standards. There are books and books printed on standards for neighbourhood development there. Yet these standards are only guiding standards, because you cannot make standards when you deal with human beings. You cannot put them in every place, in different conditions, different climates, different soil conditions. There is no such possibility of establishing standards of engineering. We can establish standards of travel or traffic, standards for lot sizes and home sizes, but we cannot establish standards of how human beings should live together.

The problem is to create a neighbourhood spirit among the human beings who live in the communities. There are standards for improvement and land-use, etc., but what must be taken into consideration is the individuality which will be in the neighbourhood. There are some things for which we can supply standards but we cannot provide standards for neighbourhood development.

J. P. Dumaresq, M.E.I.C.(6)

I agree with Mr. Faludi and also with Mr. Deacon. I feel sure some day we will have a handbook on standards, but I sincerely hope we will be able to open the covers and find therein the kind of standards we really want.

Mr. Meadows interested me greatly when he declared that town planning engineers could design and build neighbourhoods in such a way as to take the load off street parking and recreation spaces. I think this is true. I would like to carry it one step farther.

I believe the C.P.A.C. has a job on its hands, almost a challenge. I have detected in certain town planning boards or commissions a certain reticence in setting aside a large enough parking and recreation subdivision. I think the C.P.A.C. has a job to educate its own members first and then to educate town planning boards or commissions, to make sure they learn how to increase the open spaces in a new subdivision.

(6) Halifax Town Planning Commission. Spoke at the request of the E.I.C.

A REMINDER

Plans are progressing for the 1948 Annual Meeting, to be held on June 2nd to 5th at the Banff Springs Hotel. The Calgary Branch, which is to be our host, anticipates good support from the west, but the distance introduces complications for eastern members. We would suggest that the subject be brought up at branch meetings to consider the transportation question and possible arrangements for pooling resources in cars, 'buses, trains or 'planes.

Mark the Dates

PUBLIC UTILITIES

R. DeL. FRENCH

Professor of Highway and Municipal Engineering, McGill University, Montreal

An address delivered at the National Conference on Community Planning, sponsored jointly by the Community Planning Association of Canada and The Engineering Institute of Canada, Montreal, October 2nd, 1947

Before talking about public utilities, the terms should be defined. To my mind, a public utility is a public service which requires substantial investment of capital in permanent structures. Thus, I call water supply; sewerage; power supply; street lighting; burglar alarm, telephone, telegraph, teletypewriter and ticker services; fire and police signal systems and the like, public utilities. Transportation is a public utility too, but I shall not deal with it in this paper; it requires consideration by itself. On the other hand. waste removal, street cleaning, the care of parks and so forth I call " public services ". They do not involve any great investment in fixed structures and of them I shall have nothing to say, though there is much that might and ought to be said.

Surveying the public utilities of our older communities, one is struck by the haphazard manner in which they have developed, and by frequency with which extensive and expensive rebuilding has been necessary to keep them reasonably efficient, sometimes, indeed, to give service at all. A good deal of this inconvenience and expense could have been avoided had they been planned with reasonable intelligence and foresight in the first place.

But it should be borne in mind that no amount of foresight today can discount all the contingencies of the future. Who in 1900 would have envisaged Detroit as the Metropolis it has become? However it is certain that intelligent planning of public utilities will pay handsome dividends in money and in satisfactory service. The community planner will do well never to forget this fact and to remember always that good utility service lies at the bottom of modern living.

The community planner who starts with an undeveloped area is lucky. He can do with it pretty much as he wills, within the limitations of climate and topography. Most planners are not this fortunate: they must do the best they can with an area already developed in some degree, and often badly developed. Nevertheless, the differences between the two cases are not great. With an undeveloped area we have a good deal of leeway, with a developed area we have less, but as far as they may be applied, methods used in the latter case are substantially the same as those for the former. So if we discuss public utilities for an undeveloped area, any conclusions at which we may arrive will be equally useful for a developed area.

To my mind, the first question to be settled is what public utilities are required at once and what are likely to be required as the community develops, but would be an extravagance now. If the expected immediate population is over about 100 or so, the minimum would probably be water, sanitary sewers, power supply, street lighting and telephones. But in smaller settlements—and these are not to uncommon—some of the public utilities may be replaced by private facilties.

Village Utilities Need Not Be " Public "

To illustrate what I have in mind, consider the " town " attached to a large hydro-electric development with which I happen to be familiar. The maximum population will probably never exceed 75. There are about 15 houses, a school, a small chapel, and a store-cum-post-office. The houses are built in groups of two to four, and each group is supplied with water from a driven well, the pump and pressure tank being located in the basement of one of them and cared for by the occupant of that house. There is no fire protection. Each group discharges sanitary sewage to a single septic tank. Well and septic tank locations were chosen so that there should be no health hazards. and actually there have been none. No storm drainage is necessary. An automatic telephone system, primarily designed to serve the plant, has a station in the post office and a few stations in residences. Outside telephone service for personal calls is provided through a pay-station in the post office. Electricity is, of course, abundant, and cheap enough so that all cooking and heating are done electrically.

One might as well say then that in this case there are no " public " utilities, though good utility service is available. Acceptable water and sewage service are provided at considerably less cost than would have been the case with the conventional water and sewerage systems. Spreading the buildings reduced the conflagration hazard to the point where fire insurance rates are reasonable, notwithstanding the absence of fire protection. The total absence of fires of any kind in the buildings, because of the use of electricity, was also a factor in reducing insurance premiums.

As I have already said, a population of about 100 is as great as could probably be handled successfully and economically in this way. For larger places, more conventional systems are desirable and economically justified; that is, we should have regular municipal water and sewerage systems, and the telephone system should be part of the national net work.

Utilities for a New Industrial Community

Consideration of public utilities begins with the choice of site of the community. Of course, sometimes there is little or no choice, but in many cases our new communities—paper-mill towns, for example—could just as conveniently have been located on sites other than those they actually occupy. I have one in mind where all sanitary sewage has to be pumped. another where all excavation over three feet deep is in rock. So far as I can see, the first town could have been moved back from the river half a mile or so and drained by gravity at little or no extra cost and with considerable annual saving. The second town could have been relocated on an available sandy site, which would have involved the provision of more transportation for its residents, but would have greatly reduced all construction costs.

Obviously, a water system requires an adequate supply of good water and sewage must be disposed of after collection. Canada is fortunate in that neither of these is much of a problem in those parts of the country where new communities are most likely to spring up. In certain areas, however, for example, parts of the Prairie Provinces, water supply and sewage disposal require much more attention.

Having satisfied oneself that the best available site on all counts has been chosen, the next step is usually to decide land use, i.e. to locate the industrial, commercial, residential and recreational areas. Then a street plan may be prepared and lots laid out. Here the utility systems come into the picture.

Water mains, sewers, electrical conduits and the like are usually located in the streets. In many of our older cities, well developed before much in the way of utilities was thought of, there is no other place for them, but in a new community there may be better locations. Storm sewers obviously ought to be in the streets; one of their principal functions is to provide street drainage. Circuits for street lighting and for fire alarm, police signal and traffic control systems should also be in the streets for reasons of economy. Such circuits are usually overhead in small and medium sized communities, but it is worth while to consider putting them underground, for aesthetic reasons and in the Canadian climate to avoid sleet trouble. Simplified methods and new materials of construction, have reduced the cost of underground conduits of late.

Underground utility lines must be maintained and repaired, e.g. sewers usually require clearing from time to time and leaks in water mains must be stopped. These operations involved obstruction of the street surface or the opening of pavements or both, which interfere with traffic, invite accident and add nothing to the amenities. Streets must be opened for connections to new buildings, unless services are carried to the property line when the utility lines are installed, which ties up capital for indefinite periods and often results in service locations which turn out to be inconvenient. All overhead utility lines are ugly and frequently interfere with street trees.

Utility lines may sometimes be located at the backs of lots. If the street plan provides for alleys, these may be used. However, the trend of planning today seems to be away from alleys. Unless paved and cleaned as carefully as streets, they become repositories for all kinds of rubbish and hence unsanitary and an offence to the eye. Paving and cleaning cost money, and alleys are so little used that their cost to use ratio is high.

Choice of Locations

In some instances, a back-of-lot location for utility lines has been secured by reserving a " utility strip " there. This is in effect an unpaved alley from which all traffic is excluded. Abutting owners are permitted, even required, to develop the surface as part of their lots, except by building on it, but since the ownership of such a utility strip rests in the community, access for maintenance and repairs is always possible, and if operations are confined to the utility strip, abuttors have no grounds for damage suits.

An abuttor may naturally be reluctant to improve a land area which he does not own, so occasionally the utility strip is replaced by an easement or servitude along the backs of lots. This scheme leaves the ownership of the land in private hands, but provides access when required, under conditions designed to protect the interests of the owners.

Both these schemes have given satisfactory results in residential areas, but naturally cannot be used when it is anticipated that the entire area of a lot will be built upon. Which will prove the better in any particular case will depend largely on local sentiment. In either case, the position of the private utility company is the same as that of the community.

Back-of-the-lot location of utility lines offers some advantages. Maintenance, repairs and the making of service connections to underground lines can be carried out with little inconvenience and danger to the public. If there is no paving to cut and replace, there is a saving in cost.

On the other hand, service lines are likely to be longer and more expensive. Access may not be so easy as it is in the streets, particularly in the winter in a climate such as ours. If water mains are at the back of lots, and hydrants in the streets, where the fire department would prefer to have them, long hydrant connections are required. It would be interesting to secure fire department reaction to a scheme in which, say, half the hydrants were in the streets and half at the backs of lots. Even with back-of-lot location, hydrants can easily be located in streets where water mains cross them, but for good fire protection, this would not give us enough hydrants.

Overhead utility lines can just as well be at the backs of lots as in the streets, though service lines may be somewhat longer. To offset this objection, there will probably be less interference from trees, and so poles can be shorter. Lower lines and back-of-lot location, screened to some extent by buildings, make such lines less conspicuous, which is certainly desirable.

Decisions as to utilities and the location of their lines should be made before planning has proceeded too far. These decisions require careful study by competent engineers and the study must include both the technical and the economic sides of the picture.

As a parting shot, if you ever lay out a system of utility lines, do see that proper records of their locations are kept. I recall very well hunting for three days for a water main in a Montreal suburb in zero weather. It was finally found ten or twelve feet inside one property line, though nobody could tell how it got there. Presumably some revision of the subdivision was made after the main was laid, but no records could be found.

DISCUSSION

Ira P. Macnab, M.E.I.C.[1]

I would like to thank Professor French, for the thoughts he has given us on public utility practices and ideas. In dealing with the last one first for a moment, the importance of keeping records and the difficulty sometimes, of finding water mains, etc., perhaps I may give you an idea. In Halifax at the moment we are engaged in rebuilding our water system, and we are doing a great deal of service renewal work. As you know, the system in Halifax is very old and over the years the streets have been built up and the pipes are buried under several inches of asphalt so that it is difficult to locate them.

(1) General Manager, Halifax Public Service Commission.

Recently two men spent nine hours trying to locate a service line in the street. I said to one of our service engineers who had been overseas during the war, "Why couldn't we use mine detectors in cases of this kind?" He thought it was a good idea, and in ten minutes our young fellow had discovered the pipe, in fact, the first time he went over it. He said: "I think it is there. Put your pick down." The fellow was just one inch from it. Perhaps that is a tip that some of you can use.

Our main concern is, of course, service to the public. I have been thirty-five years in public service work, in South America, Mexico and Canada, and I have had experience in practically all angles of it. To me it is a fascinating job. I would define public utilities in a slightly different manner to Professor French's. To me a public utility is an industry rendering public service for revenue, of such a nature that it can be carried on by monopoly under regulation to greater advantage than by competitive industry. I have spent a good many years preaching that definition and I think it is a reasonably fair one.

Now as to the planning of public utilities, that, of course, must fit into the needs of the area that is already there and on which the district will be planned. In the 35 years I have been in this work there have been tremendous strides and development, especially in the electrical public utilities. We must expect those changes to continue. I think in planning public utilities, particularly electrical public utilities, one can see only a reasonable time into the future. It has been my experience that seven years is about as far as you can plan ahead without being too far off the mark.

However, in reaching a time I think it is essential, if it is an old community, that you plot the community, make a graph of that and also plot a graph of the growth in the use of electricity or any other service you are selling, such as telephone, gas, etc. By combining those two graphs you can with reasonable accuracy project your future trend and plan accordingly.

In this country our communities are fairly well divided between those with municipal or public ownership of utilities. We have in many sections of Canada privately owned electric utilities, we have privately owned telephones and we have in some few cases privately owned water systems. There is very often a considerable difference in the operation as between private and public ownership. It has been my experience that the haphazard utility has been more frequently municipally owned than privately owned. The reason I say that is because very often the limits placed by city charters, or by city or provincial legislation on operating engineers and town councils, make it difficult for the operators of the utility to carry out plans which they know should be carried out, but for which the money is not immediately available or for which the council sometimes finds it difficult to find the money.

If it is a necessary, useful and profitable venture, the private utility will always go in. My experience has been that they will look into the future and very often will take more care in their planning than the municipally owned systems. That, of course, has very definite exceptions. I think probably your Ontario Hydro is the great and shining example of that. I have only just now finished reading a book called "Adam Beck and the Ontario Hydro" written by Truman which is a most interesting and enlightening book on municipal affairs in the Province of Ontario during the period of that development.

I think there is another important consideration, particularly coming to water and sewers. We are inclined, almost universally but not quite so, to sell water and pay for sewerage systems by taxes. I have for some time been of the opinion that this is not sound, and I throw out for your consideration the fact that many sewer systems are there only to carry away the waste water and therefore the sewerage system of any municipality is actually a part of the water system and necessary to the water system. Therefore I feel that the time will come, and in fact it has already, particularly in certain parts of the United States, when the sewerage systems and the water systems are operated as one, under one management, and you pay for the use of your sewerage system through the water rates. That, I believe, would be an added economy and would result in greater efficiency of operation of these two essential services.

Another most important thing I have found in planning for water is the consideration of health. In many cases I have found where water mains were laid down without giving any consideration to the location of the sewer line, perhaps alongside or above or just below it. That is of course contrary to good practice, but I am afraid it has often been done. I believe if these two services were under one management such conditions would not exist, and we would have a more efficient system in the end.

I do not believe that water and sewer pipes should be laid in the same trench, ever. There should be adequate provision to keep them apart. I think the two great considerations in water are (1) the source of the water and (2) the nature of the water that is available. You in Montreal and Toronto and some of the other large cities know that the cost of your water is greatly aggravated by reason of the fact that you have to treat and filter at great expense the water to make it fit for human consumption. In the East we have not reached that stage as yet. We have many lakes. We do have, however, a tendency, particularly in Halifax, toward leaving our watersheds unprotected. They are now being controlled by the city council. It is most important, in my opinion, in a watershed area to assure that the water be well protected.

Another most important feature is the composition of the water. That I think deserves much more consideration than it has been given in the past. The water should be carefully treated. The cost in our city of treating the water because of its chemical composition, is terrific. We have water with a PH value of under five. The result is that there is great oxydization, and our industrialists have to spend a great deal of money treating water. I believe it could be treated at the source, and we have lately been running a series of experiments to correct that condition without disturbing the general stability of the water.

So I say that at the source of water great care should be given to the type of water, and if treatment is necessary it should be provided at the time the system is installed.

Col. Jean P. Carrière, M.E.I.C.(2)

In this discussion of Prof. French's paper on "Public Utilities", I wish to deal first with the problems which

(2) City Manager and Chief Engineer, City of Hull, Que.

face engineers charged with replanning and revamping existing public utilities in medium and large municipalities. Prof. French has ably pointed out the haphazard manner in which some of the public utilities have developed in many of our older communities; it is enlightening to study the reasons which have led to such a state of affairs.

In most cases we find that either no plans of the utilities concerned exist, or that those which exist are inexact and often in contradiction to proper engineering design. Such faulty records lead one to conclude that no *proper* engineering studies were carried out in the initial steps of development. I consider this the primary cause of the trouble.

I agree fully with Prof. French that in replanning an already developed area, one must use methods which are substantially the same as for undeveloped ones; the basic studies are carried out as though no development existed, after which an attempt is made to fit existing utilities into the new plan in accordance with the requirements. Being at the moment faced with that problem I feel free to state that it is not always an easy task.

Taking second place in the priority list of reasons which have led to improper development of certain public utilities, I list what I call "false economy". This false economy is usually the immediate result of improper planning where initial cost is given priority over all other factors. When this is the case, the planner has to accept the additional task of re-educating the property owners, through the proper channels, as regards the attitude they must take in comparing initial cost against cost of maintenance, permanency and utility. Unless he succeeds in this task the planner is liable to see his plans pigeonholed and forgotten.

I could list many more reasons which have led to the deplorable condition of some of our public utilities, but they are mostly obvious and deserve little attention in this discussion. I assume that you agree with me that at some time during the course of replanning, we must review at least the most obvious reasons which have led to the necessity of replanning, in order to prevent their recurrence.

The second point I wish to discuss concerns the needs of municipalities for "public utilities". Prof. French has already dealt with the needs of very small communities which can be met without the use of public utilities. It is elementary to state that in all cases, citizens must at least be provided with services which are conducive to sanitary living conditions. There are however certain public utilities and amenities of life which we must be careful not to impose on the citizens of a community if there is a possibility that their cost may be too heavy a financial burden for them to carry.

We are all too familiar with the type of person whose greatest ambition is to "keep up with the Jones's"; whose tastes and supposed requirements are much superior to what they can afford; who have no sales resistance and will buy all kinds of gadgets whose maintenance they can't afford and whose utility to them is doubtful. Somewhat the same attitude is sometimes found in a community as a whole when it comes to public utilities; citizens will clamor for certain utilities which they can't afford immediately and even go so far as to refuse to spend the necessary moneys to improve existing unsuitable basic sanitary utilities.

In one town that I know, the waterworks require immediate improvements: the consumption of water is over 400 gallons per capita per day, due to wastage brought about mostly by failure of proper maintenance; there is no filtration plant although eels, lizards and other animal and vegetable matter flow through even house outlets; the combined sewerage system is dilapidated and insufficient for the needs of the community and every heavy rainfall is followed by flooded cellars and streets; yet the citizens favour expenditures of moneys for immediate paving of streets over these faulty utilities, for municipalization of electricity, for the construction of parks and driveways rather than for the correction of the existing unsanitary conditions. This may be a rather extreme example to use as an illustration, but it is an actual case.

When faced with such conditions, the planner must decide by himself what the real needs of the community are, so as to incorporate them in his plans, in the proper order of priority, notwithstanding public opinion; if he wants his plans to be realized and not to become merely beautiful pictures and drawings, he must take advantage of all opportunities to educate the citizens as to the proper course to follow.

Community planning is not a task, it is a mission; to be successful, a town planner must be a missionary at heart. Like the true missionary, he must have the courage of his convictions, and claim success solely in the light of services rendered to the citizens.

C. J. Desbaillets, M.E.I.C.[(3)]

Professor French, as a good professor of municipal engineering, has told us in his paper exactly what to do. He probably has the easiest part of it. We have here in Montreal attempted to follow his principles, and I well remember some 27 years ago when I saw on my desk a resolution of the City Council announcing we had $6 millions to spend on improvement of aqueducts. When I heard people talking about the story that we had to spend $6 millions of their money, I began to think that nothing should be wasted, and the next day, assembling all the engineers of the various sections, we tried to establish all these different branches of utilities, particularly for the aqueducts.

As Mr. French stated in the early part of his speech, these utilities represent substantial investments, and we thought we would determine as closely as possible in every branch of the utilities what this substantial investment should be, what part of the total expenditure. In other words we came to the conclusion what the substantial permanent investment should be. For instance, we determined for the waterworks, the system in general, reservoirs, distribution system, pipes, everything that we use to deliver the water to the consumer, as to how each should be built in the best possible manner, with the best material, so that there would be no need to touch it for ten or twenty years.

We consider that a valuable part of the investment, the part used for materials, machinery, etc. that needs to be replaced, which is made obsolete by progress. If you can reduce that part of the expenditure to a minimum by careful planning, you will consider that you have done your duty to the citizens in the spending of their money. The most economical way in the long run is to buy the best possible material.

(3) Chief Engineer, Montreal Water Board, Montreal.

In the matter of pipes, our experience has shown us that the life of reinforced concrete pipe will outlast all others. It is immune from electrolysis. It cannot burst. You must not forget that in Montreal there have been as many as 28 burst pipe catastrophes on large mains. The two last cost around $300,000 each in damages. So we thought when the City had to pay damages it was time to do something about it.

After hearing that certain cities in Scotland had invested in concrete pipe, and had been using it for the last 25 years, we said: " If Scotchmen go to France and buy concrete pipe, it must be good ". So we invesigated. Some of these pipes were supposed to withstand up to 70 pounds pressure. We applied 700 pounds before any damage was done. After thorough investigation we decided we would use reinforced concrete pipe. We have put in already more than 20 miles of that type, and have had not the slightest bit of trouble.

You can lay these pipes one foot higher in frost. Our experience with metal or steel pipe has really been disastrous. We have some fine steel pipe coated with the best domestic coating, and after 15 years no coating is left and half the pipe is gone. In some places they last a bit longer. On the other hand the soil is not harmful to concrete pipe. It is absolutely immune to alkali. I am just telling you this in connection with our aqueducts.

We came to the conclusion that this matter should be studied closely, and we took sections of various pipes and compared them. Some trouble is caused by careless design. In reinforced concrete you can do a lot in design. Some are perhaps 10c a foot more than others but it is well to remember that 10c may be carried for 20 miles. It is well to test a lot of pipes and finally come to one of which you can say, " This one cannot be improved ".

You know we are modernizing the electric lights in Montreal. You have probably heard that for a number of years. It really takes several years to decide what to do. We have been working a long time on that. The trend seems to be toward an improvement of series lamps, and working on filament capacity. Some companies foresee that the improvement on the series system will mean more copper, and we would want to lay a permanent circuit, a fundamental circuit. On the multiple system everything is based on 110 v. or 220 v., and this would seem to be an efficient system for various reasons. So we come again to the conclusion that the multiple circuit will probably be a good basis for the years to come.

I have tried to give you two examples of how to get at this problem, always bearing in mind that it is the citizens' money being spent. It is important to find the most permanent method of doing things. It is like building a foundation. In one of our stations we have foundations that accommodate five different pumps, and it did not cost more, simply because we gave the whole matter advance study.

While I am on the subject, I would like to mention another thing which I have found throughout Canada. In various other cities, the tendency is to ask for the best right of way possible. I maintain that if you don't give the power companies the best right of way possible, in order to avoid the shifting of lines, the service will suffer. We have attempted here in Montreal every time the Montreal Light, Heat & Power Co. asked for a right of way, to give them the best we could, even sometimes going through our parks, because we knew in the long run it would be best for everybody.

W. C. Miller, M.E.I.C.(4)

Planning for utilities connotes consideration of the arrangement of the public utilities of a community in such a manner as will provide the maximum of service for minimum cost. It presupposes that the service to be provided is economically sound, and that it may be paid for by responsible persons or corporations without serious impairment of their financial resources. Planning is in its essence just another application of ordinary engineering economics. It is the engineer's regular work to coordinate all the separate parts of the problem into an intelligent whole. In the course of his study he may find it desirable to build a more expensive structure at some particular point in order to increase convenience or to reduce overall costs.

The planning of utilities is therefore an integral part of community planning, and should never be completely divorced from the planning of the rest of the community facilities. The writer has seen the plans of a neighborhood unit that seemed well designed from the point of view of community amenities. It has quiet residential streets with pleasing lines and profiles. Through traffic is routed over special non-residential routes. Many other similar desirable features are found in the design.

However, the street junctions are so located that on a large part of the work it takes about twice as many manholes on the sewer system as is usually considered necessary. Instead of manholes located at 300 to 350 foot spacing, as is usual, we have some blocks of over four hundred feet, too long to leave out a centre manhole, and therefore establishing a 200 foot spacing. The need for manholes at each street intersection where branch street sewers join and change direction required installation of manholes at a number of successive " T " intersections. These gave spacings in some cases as low as 150 feet. Now since manholes are currently costing $500 each or more, this street design is adding from $2.00 to $2.50 per foot to the cost of the sewer or about $70 per lot. Perhaps the lots may be worth the $70 each to maintain the street layout. In any event the sewer design should be carefully considered as a factor in street layout, both in connection with manhole spacing and the general topography of the district, with its effect on sewer grades.

In another case the street location based on topography provided such level street surface grades that there was occasionally some difficulty in getting a grade that would give a decent gutter velocity to carry away storm water and accumulated dirt without the use of curb faces that were too high to permit automobile doors to open. In such a case self cleansing sewer grades could only be obtained by digging deeper as the sewer progressed to the outlet. As the cost of sewer excavation per cubic yard increases with depth, such a street layout added further to the expense to be borne by each lot. It should be decided beforehand whether this extra expense is warranted by an increased lot value. In many cases moderately rolling grades are desirable rather than objectionable, and on curved streets they are not so apparent to traffic. They usually reduce excavation costs in sewer work.

Wiring for street lighting will be required on streets. Power lines for house services at the back of the lot

(4) City Engineer, St. Thomas, Ont.

increases service costs, but it can usually be justified by the establishment of joint leads with the telephone company. The street lighting circuit may be armoured cable laid in the boulevard thus eliminating overhead street wiring.

Our practice is to reserve an easement for wires, pipes, conduits, or the back six feet of the lot. Wiring on this easement is usually overhead, except for the part of the line nearest the street where a street crossing is required. By arranging pole locations near property lines there is no substantial interference with the use of the land by the owners.

Water and gas lines and storm sewers are best laid in the boulevard if possible, but sanitary sewers are usually best laid in the centre of the street. Unequal costs of private drain connections result when the centre location is not used. On curved streets however, it is impossible to avoid this difficulty, since sewer lines should be laid in straight lines between manholes. In such cases the manholes may be built slightly off centre line in order to keep the entire line of the sewer as near the street centre as possible. It is difficult to foresee any case in which the water line could be placed at the rear of the lot to any advantage. The back of the lot is certainly not a place for a fire hydrant. Cars parked in private driveways would create obstructions to the operations of the Fire Department, and snowdrifts between houses would make access difficult.

The planning of public utilities is an integral part of community planning. In many cases it is the sheet anchor that will prevent a subdivider drifting into an ethereal street design which looks magnificent on a many coloured drawing or model, but which, if followed, would create unjustifiable expense in the development and subsequent maintenance. It should be reiterated that community planning is just another opportunity of using the recognized principles of engineering economics. It is an opportunity for making a carefully considered balance between the greatest justified good and convenience and the minimum justified cost, always remembering that the most ideal plan will come to grief if the property cannot support it financially. Planning of utilities must be done in complete harmony with street and property planning, but the planning authority must recognize that the converse is also equally true.

Professor French has clearly set out most of the points to be considered in this connection.

W. D. Hurst, M.E.I.C.[5]

Mr. Hurst was unfortunately unable to be present at the meeting. His comments were submitted in writing.—Editor.

Professor French's subject is of very great importance to those who are charged with the planning of communities and equally important to those who are charged with operating and maintaining the services supplied.

Professor French's definition of a " Public Utility " seems rather unusual and differs from my own conception. I always conceived a public utility as a service, essential to society, carried out under government compulsion either through ownership or regulation and differs from private business in that in the latter one may sell or not as he pleases, manufacture what he wishes, demand any price that the traffic will bear, and offer any concessions that may appear advantageous while, on the other hand, a public utility must serve all that apply, exact only lawful and reasonable charges for service rendered and make no discrimination between consumers.

As to the distinction between a public utility and a public service it seems to me that a public utility provides service to groups of individuals or to a community which service can be conveniently measured and accounts rendered periodically, therefore making possible operation on revenue obtained, while a " public service " provides service to the community as a whole which service cannot be easily measured and is therefore charged to the community at large in the annual taxes. Typical examples of public utilities would be water supply, electric power, gas, sewage disposal, telephone and, of course, transportation. Typical examples of " public services " would be fire and police protection, street lighting, care of streets, parks, health services, welfare, etc.

At the present time in Winnipeg, garbage collection and disposal is operated as a public service but serious consideration is now being given to change over to a public utility basis and charge rates for this service similar to those being presently charged for water supply and sewage treatment and disposal.

I am entirely in agreement with Professor French's assertion that had communities been planned instead of being allowed to develop in a haphazard manner, that a great deal of inconvenience and expense could have been avoided.

However, as Professor French has pointed out, hindsight is a great deal better than foresight and who can honestly say that he can anticipate now what will happen 20, 30 or 50 years hence.

Hence planning should be carried out in a general way and not become too detailed. A plan should be a living plan and should be revised year by year as development takes place.

Zoning is one of the most important elements of planning and is taken very seriously in Winnipeg. In the early days before zoning ordinances came into being, industries were located haphazardly and today in Winnipeg we have a large industry in a location where sewer service is not likely to be available for many years to come. The City now has a firm policy not to sell municipality owned lands for any purpose except where utilities, such as water and sewer, already exist or where they can be easily installed.

Much discussion has taken place on the merits and demerits of the grid street plan, the service lane —cul de sac plan (such as the Radburn Plan). Each, of course, has its advantages but in Winnipeg the grid plan seems still to be favored.

The newer residential streets in Winnipeg have a 66 ft. width. There is provided on the street a 24 ft. pavement, two 5 ft. sidewalks and two 16 ft. boulevard strips. At the rear of the lots there is provided a 20 ft. lane. This layout has proven to be very successful for the following reasons:

1. Underground utility services are laid in boulevard spaces, consequently disturbance of the paving is avoided when installing services or making repairs.
2. Overhead utility services, which are usually unsightly, are placed in the back lanes.
3. Service drive ways are prohibited from the front street except by special permission of the City Council.
4. Garbage cans, refuse and other unsightly material is kept off the front street.

(5) City Engineer, Winnipeg, Man.

5. Snow clearing is simplified, the snow being ploughed from the street into the boulevards and from the sidewalks onto the boulevards. (In this connection it is to be noted that although the winter of 1946-47 was one of the worst winters for snow that this city has ever experienced, 98 per cent of all streets, in the city, were completely ploughed and open not later than 12 hours after any snow fall.) If no boulevards were in existence the snow would have had to be removed entirely or ploughed against garages and other personal property. I think it would be very difficult to convince the people of the City of Winnipeg that they should do away with lanes or alleys, and change to a utility strip or cul-de-sac type of development, as seems to be the trend elsewhere, even though the " cost to use " ratio of lanes is high.

In a recent development near Winnipeg the houses are face to face with a sidewalk running down the centre of a grassed area, and the houses are arranged in a cul-de-sac with a service lane at the rear. As one drives down the main avenues off which the cul-de-sacs run, the psychological effect is that the eye is drawn, not to the grassed area at the front of the houses, but to the paved service lane at the rear with its assortment of garbage, garages and other necessary service facilities. Moreover, I am informed that some of the housewives are already objecting to the arrangement, as the back door tends to become the front door, being used by family and guests arriving in cars.

I personally do not like the cul-de-sac type of development owing to the poor layout of fire hydrants associated with it, resulting in higher losses of head. We have found by comparative analysis that the cost of a watermain layout avoiding dead ends is greater for this type of development than for the conventional grid type. Of course the number of square feet of paved streets and sidewalks for the grid pattern is greater than for the cul-de-sac pattern. This to me does not seem to be a bad fault, particularly as regards streets in view of the increasing density of motor vehicle traffic.

It is interesting to note that the Community Builders Council of the Urban Land Institute of Washington, D.C., which Council is composed of men chosen for their broad experience and general knowledge of community planning, reported last December as follows:

" In the Radburn Plan, the houses face a sidewalk right of way or sometimes are common with the rear of the houses facing on a cul-de-sac or court which provides the vehicular and service access. This type of plan has not met with acceptance, and has, after much observation and a number of similar experiments, proved unsatisfactory."

It would appear that the people of North America do not want the peace and quiet of the cul-de-sac, service lanes without streets, or cluster houses using a common walk—they prefer the open road. We have a number of cul-de-sac streets in Winnipeg where the assessment value, which reflects the result of buying and selling over a period of many years, is 10 per cent lower than on the through streets.

Professor French has stated, " Which will prove the better in any particular case will depend largely on local sentiment." This certainly seems to be the case in Winnipeg.

Professor French has pointed out the very great importance of keeping proper records of the location of utility structures. He is certainly right. This matter is of the utmost importance.

More and more underground services and the available space in the streets is rapidly becoming exhausted. It is imperative that the most efficient use be made of the available space, and that this space be fairly allocated among the utilities, and that detailed records be kept of the construction. The excessive cost of trying to locate " lost utility structures " and the damage caused by inadvertently driving a jack hammer through such structures as trunk telephone lanes, would pay over and over for the keeping of proper records, to say nothing of the dangers involved to men striking high tension electric conduits and the disruption of service to the community.

Professor French is to be congratulated for bringing so forcibly to the attention of the conference this most important problem of the responsible planning of public utilities.

R. D. McKay, M.E.I.C.[6]

Mr. Carriere spoke of the need of original planning and of the tendency to over-expand in undesirable directions. There is no question that we need original planning in these utility matters and I would like to caution all such engineers against the use of " rule of thumb " planning. For instance, it has often been stated axiomatically that a water main should never be less than 8 in. in diameter. In many cases this is untrue, particularly in Halifax, where the water is corrosive. In places like that, the effect of a large main on a residential street with little use is almost the same as the effect of a dead end. A very serious problem may arise in the matter of corrosion as a result of what the " rule of thumb " engineer would tend to regard as good sound engineering practice. I believe caution is necessary and that we should try to avoid this " rule of thumb " business.

A. E. K. Bunnell, M.E.I.C.[7]

We hear much of the need for housing, and I think General Young, Vice-President of The Central Mortgage & Housing Corporation, could very appropriately explain to the meeting the difficulties that those who are desirous of building houses either in public housing for rental, or housing for home ownership, are finding in assembling land sufficiently serviced with those services to which Professor French has referred this afternoon, and which are an important part of suburban living. Explanations of these conditions are deplorably short, and perhaps General Young will quote two or three examples of projects which have failed to succeed because of the municipality in which the project was suggested having been unwilling to furnish the services.

I know in the Toronto area there has been a great surge of new industry, bringing new people to the area, yet the amount of additional housing has been deplorably low. Part of the trouble is that we have too many units within our corporate boundaries, which are arbitrary lines at the best. They are no longer adequate, yet we cling to a system by which we each must exercise local autonomy within these corporate lines. It just is not working, and I am going to ask General Young if he will make a few remarks on those observations.

(6) Sanitary Engineer, Dept. of Health of N.S., Halifax.
(7) Consultant, Ont. Dept. of Planning & Development, Toronto.

Major-General H. A. Young[8]

As Mr. Bunnell has indicated, one of the greatest problems today in providing houses is the lack of public services. Back in the days when municipalities were developing communities it was common practice to have these services put in well in advance. But that is not the case at the present time. What is more, in many cases they do not feel that, even apart from the necessary services, they have the means to co-operate in the provision of schools. In the Toronto area we have perhaps one of the worst examples, but there are others. We have reached the situation now where we cannot build houses in the Toronto area. Some of the municipalities absolutely refuse any construction unless schools are built by some other organization or department of Government. The City of Toronto itself has not got the land unless they start slum clearance, which I hope they will do soon. There is no land available in Toronto. The surrounding municipalities are emphatic that they will not allow any housing projects to develop. Even apart from the schools you have the general question of services. There is one instance where an organization proposed to take on a large-scale project of some 300 acres and build the houses. They will carry the project right through. But the municipality has no services.

We have gone to Mayor Saunders in Toronto and explained our need for sewer facilities, and he said "Our sewer lines in that area are overloaded now. It will cost $6 millions to extend those services to that municipality, and I cannot see my way clear to do it." So that project is bogged down right now on that basis. Toronto is not alone. The same problem exists to a lesser degree in other cities. Montreal is not quite the same. We are working on a project there now which would provide 530 units.

The whole housing problem in Canada is so vast that we cannot meet it with little projects of five and ten houses each. We have got to get going on 500 and 1,000-unit groups. Until the planning is affected, and until we get some better arrangement for the metropolitan areas to give community services, or unless the city will extend out and annex adjacent municipalities or property, I am afraid our housing is going to be bogged down. It is going to be a matter of slum clearance and at a very high cost.

Many factors enter into the difficulty, high costs, inefficiency of labour, and shortage of materials. But the real crux of the housing problem across Canada today is the lack of serviced land. I think anything The Engineering Institute of Canada and the Community Planning Association of Canada can do would be invaluable at this time. Pressure can be brought to bear on municipalities, perhaps, and on provincial governments to lend greater assistance now. Unless this can be done I am afraid we are not going to solve this great problem of housing shortages. Unless we can get land and build on a big scale, unless we have several projects going, of over 500 to 1,000 houses each, we are simply not going to meet our problem.

I don't know that there is any direct message I can give you, in the planning of this Community Planning Association. I think the various public bodies, particularly the Royal Architectural Institute of Canada and The Engineering Institute of Canada could do a great deal in the direction of overcoming this great difficulty today.

(8) Vice-President, Central Mortgage & Housing Corporation, Ottawa.

PUBLICATION OF REVISED MEMBERSHIP LIST DEFERRED

In the August issue of the *Journal* there was a request for information required to facilitate corrections to our Membership List.

To date, 50% of the cards have been returned. It has, therefore, been decided to defer the printing of a revised list.

The cards which have been returned will be used to correct the present list.

Please advise Institute Headquarters, promptly, if you change your address or professional position

PLANNING IN GREAT BRITAIN

F. J. OSBORN

Chairman of the executive of the Town and Country Planning Association of Great Britain

A condensation of an address delivered at the National Conference on Community Planning, sponsored jointly by the Community Planning Association of Canada and The Engineering Institute of Canada, Montreal, October 3rd, 1947

The author describes the forces behind the British Planning legislation. Pointing out that Britain's production is predominantly mining, industrial and commercial, he shows the resulting evils of urban concentration and the spoiling of rural areas by influx of those trying to escape this.

Tracing the growth of modern town planning back to the foundation of the Garden Cities Association in 1899, he shows that body's influence on legislation and its development, as well as that of the public housing movement, explaining how each is supplemented by the other as well as by the "amenity" societies.

Further planning legislation arising from war devastation is chronicled and its aims and accomplishments outlined. The author tells how public opinion is developed and enlisted, and how its will is in turn implemented by planning. He warns that "planning" must be confined to planning what the public wants and can get only by means of that planning.

Your Community Planning Association seems to be exactly the sort of thing required to give a lead to public opinion on physical planning. When I first read your Bulletin, *Layout for Living, No. 5,* my thought was: Why haven't we anything as direct and pointed as this in Great Britain? I don't know any document that so practically and logically tells citizens how to set about organizing a local planning group. I know not by what stroke of luck or judgment you seem to have got together a central group that understands what community planning could do, and knows how to pass its enthusiasm on.

Springs of British Planning

Town and country planning evolved slowly in Great Britain from 1898 up to the Second World War, and with tremendous speed after 1941. The recent changes of policy and technique, indeed the changes of aims, are so great that it is difficult to sum them up briefly.

The major motive force in British planning legislation and policy has not been aesthetic or architectural, but social and economic. The planning movement is a direct descendant of the moral revolt of public opinion against the hideous conditions of living in the towns created or debased by the Industrial Revolution. At the roots of it are the resentment of the masses that they have been herded together in squalid districts. Sanitary and building bylaws were the earliest expression of this revolt, which for nearly a century was effectively expressed only through the compunction of the few who exercised political power.

With the broadening of elective democracy the direct influence of the badly-accommodated masses came into the dynamics. The real force underlying the movement towards planning is essentially social, and drives towards more spacious and private living conditions rather than towards architectural harmony or orderliness or any such refined and cultural aims. Aesthetic aims are aims of great importance, to which the evolution of planning power gives inspiring opportunities. But they have not been, and are not now, in Britain at any rate, the aims that engage the support and votes of large masses of electors, or of legislators who seek to interpret the interests of electors.

Let me recall the main facts of the physical layout of Great Britain. Because of its fertile soil, its vast coal deposits, and its commercial position, it has become a densely populated country. By mining its coal, which at the present rate of cutting will last for 600 to 1000 years, and using its technical skill in manufacturing and tradition in trading for export against imports of food and raw materials, Great Britain can continue to support a large population. We are unshakable believers in mechanical progress, and we are not all bad at making contributions to it. So although it means having only about 7 per cent of our people actually living by agriculture, and 85 per cent living by urban occupations, very few people in Great Britain think there is anything fundamentally unsound or unstable about these proportions.

What we have come to think *is* radically wrong is that no less than half our urban population, perhaps 19 million people, are massed in seven great cities or urban clusters. Half of these (20 per cent of the entire nation) lived in 1939 in Greater London. What is more, as in all industrial countries, there has been an accelerating movement towards London and the other great urban centres.

Now it is the evils that result from this excessive concentration in particular cities that have been the real stimulus to our planning movement. The desire to live near work produces first a central congestion of housing, with the cutting-up of dwellings into apartments, over-crowding, and the gradual replacement of single-family by multi-storey dwellings. And therefore you get the flight of the better-off families to the suburbs. This has not gone so far as to empty out large sections of the cities and produce a tax-delinquency problem; but nevertheless the phenomenon of "blight" exists, in that down-town residential areas have depreciated steadily in the last 40 years, and rebuilding is impossible without enormous public subsidies. It is an amazing paradox that while a wealthy and prosperous city continues to grow, and hundreds of thousands of people spend anything up to two hours a day and a large slice of their earnings in shuttling backwards and forwards daily, modernization of housing in central districts is financially unremunerative.

Alongside this disease of hypertrophy of cities, we have been conscious in Great Britain of the complementary disease of decline and anaemia in our rural areas and in country towns dependent on agriculture. In the rural areas nearer the cities a new unpleasantness has come; partial replacement of the agricultural economy by a sprawl of buildings along radial roads, houses in which townsfolk escaping from central squalor go to live, and petrol pumps and shacks which serve the week-end motorists.

The Making of the Movement

Remedial action did not in the nineteenth century advance beyond sanitary and building regulations. The modern town-planning movement began with the foundation of the Garden Cities Association in 1899. It was never a large society, but it had members of energy and initiative. One of the first things it did was to promote the building by private enterprise of the new town of Letchworth Garden City on a virgin site, as a demonstration of the way to reconcile the desire of the masses for garden homes and good community living, close to work, with the economic needs of modern industry. Later the Association promoted Welwyn Garden City, a more advanced illustration of the same principles.

What I want to stress is the profound influence exercised by the Garden Cities Association group on the development of planning thought long before the planning profession came into existence. Their appeal was to the widest possible public, not specially to technicians. Having come together to advocate an idea, they succeeded in arousing public interest and thereby moved legislatures.

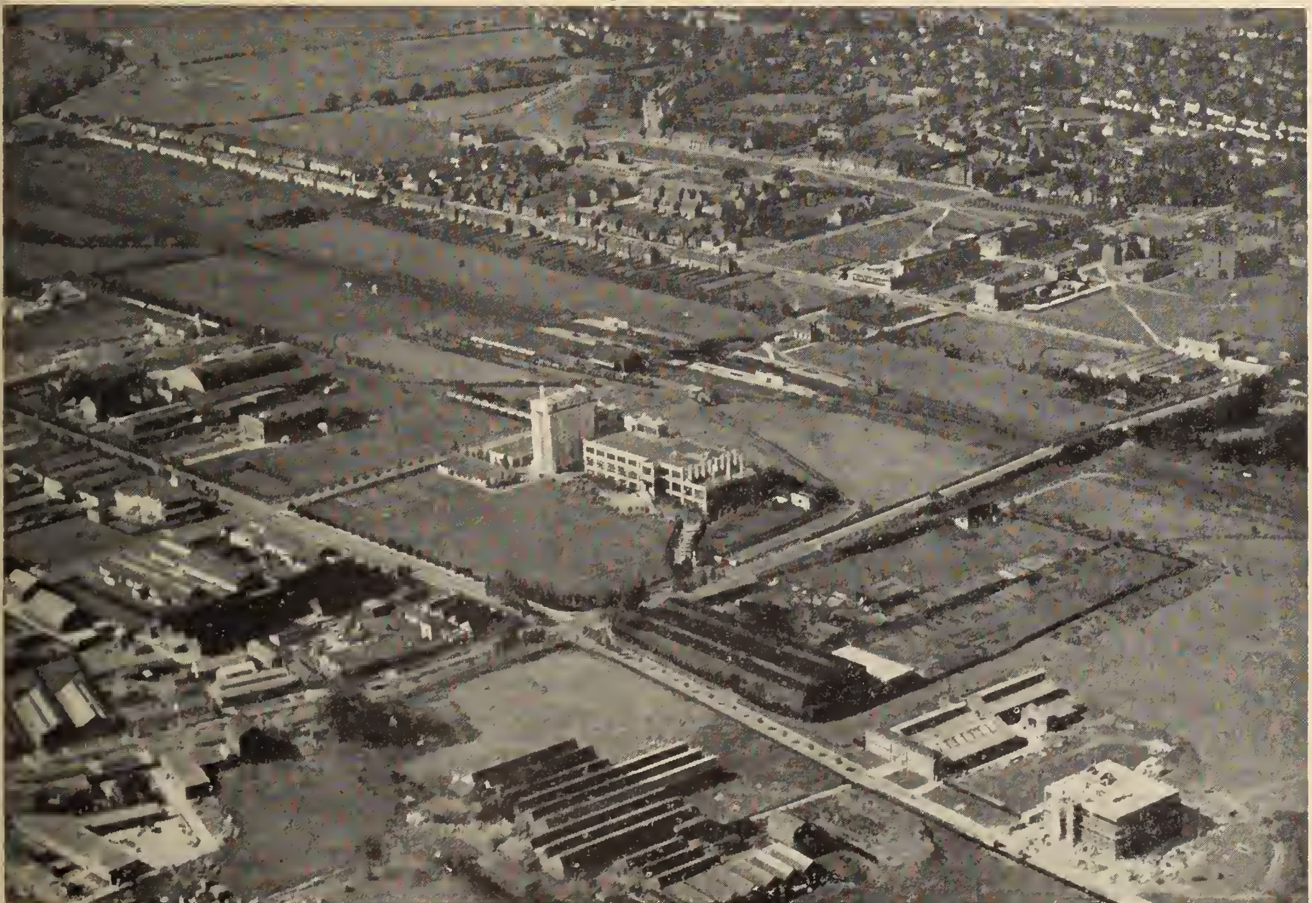
In 1909 Great Britain adopted a permissive system of statutory planning. This began with the regulation of town-extensions, by the now familiar methods of zoning, prescription of road lines, and density control. The Association took up this allied subject along with its advocacy of dispersal to new towns, and enlarged its name to the Garden Cities and Town Planning Association. Its membership remained small, and it exercised its influence through a monthly Journal, occasional booklets, ceaseless lecturing, and direct pressure on Ministers and Parliament. Its personnel contributed a considerable quota to the new profession of Town Planners, many of whom got into key positions in the administrative set-up or became professional consultants. Later the pioneer Town Planners formed their own professional body, the Town Planning Institute, which in due course set up its examination system and granted certificates of qualification.

In the meantime the public housing movement, springing from the same origins developed independently into a force of vastly greater political strength than town planning. Apart from the Garden Cities Association, I do not think any particular society or group of societies can be said to have made the public housing movement. The voluntary movement took the form of organizing and financing housing societies and associations for the construction of housing schemes.

The Garden Cities Association, having experience in such practical work, took the lead in stimulating the formation of house-building societies, and established the National Federation of Housing Societies, which now has a separate existence with official financial support. It also joined with other enthusiasts for housing in setting up the Housing Centre, which became a venue for exchange of ideas and information between societies and local authorities. The local authorities

WELWYN GARDEN CITY

An aerial view of one of Britain's best known Garden Cities showing the industrial section, the railway and the "Centre".



WELWYN GARDEN CITY

Hertfordshire, England

(*Top right*) **"Welwyn Stores"—The new building.**

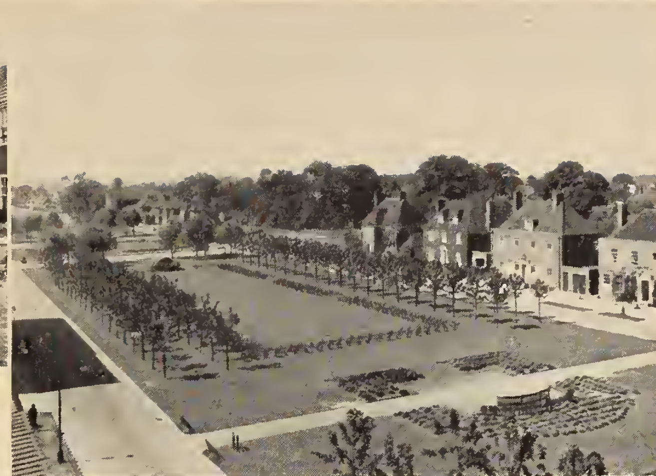
(*Top left*) **"Handside" School.**

(*Top centre*) **Some new homes for artisans—of the maisonnette type—on Ludwick way.**

(*Lower centre*) **Rear view of apartments above "Welwyn Stores"**—(*see top-right illustration*).

(*Bottom left*) **Houses on "Parkway".**

(*Bottom right*) **The Community Centre.**



(*Top left*) **"Walden Place"—A section of the lower priced homes.**

(*Top right*) **A section of "Parkway" Gardens.**

(*Top centre*) **The commercial section on "Howardsgate".**

(*Lower centre*) **Some of the new homes on Digswell Road.**

(*Bottom right*) **Barclay's Bank building and the Post Office.**

(*Bottom left*) **"Howardsgate Gardens"—The building in the centre is the "Shredded Wheat" plant.**

Photos by: Studio Lisa, Welwyn Garden City.

Courtesy of: Emile Nadeau, Esq., M.D., D.H.P.

responsible for housing and town planning set up another very vigorous organization, the National Housing and Town Planning Council, which holds frequent large conferences, attended mostly by members and officers of local authorities. But public housing policy does not now derive from any *ad hoc* society. It has become a fundamental part of national economics and politics, and all parties place it high in their programmes, with varying views as to methods, but with unanimity as to scale and standards.

Differences of Accent

Of much importance in the recent history of town planning has been the growth of what are sometimes called the "Amenity Societies". The origin of these

GREENDALE

WISCONSIN

Typical homes, with attached garage—note thelands caping.

A typical home of the bungalow type.

A view of a section of the town—note that the houses are detached.

Photos courtesy of:
The National Housing Agency *and*
Emile Nadeau, Esq., M.D., D.H.P.

is entirely different from that of the Garden City movement, and indeed at times their objectives have tended to be in conflict, though this has never developed into overt opposition. The key organization of this group is the Council for the Preservation of Rural England (CPRE) and its sister organizations for the other parts of Great Britain. To these are affiliated a large number of County Preservation Societies, the Society for the Preservation of Ancient Buildings, and Societies watchful for the amenities of the Lake District and other areas of special landscape beauty. Essentially it is a movement of country-lovers, of well-off country dwellers and enlightened landowners. In alliance with agriculturists the preservationists have looked with doubt at the demand of the Garden City movement for new towns for the "overspill" of the tightly-packed urban millions.

The new policy gradually adopted by British Governments between 1942 and 1947 reflects the resultant of the pressures exerted by many voluntary groups, and the supporting or opposing pressures of Ministries concerned with land-use and the local authorities. It reconciles all responsible views very acceptably.

Strangely enough, none of the great political parties were a popularizing factor in the making of policy for planning—in the way that they were factors in the housing movement of 1918 onwards.

In 1943 the Ministry of Town and Country Planning was created, and planning control extended all over Great Britain. In 1944 an Act was passed giving local authorities power to buy up large areas of "blitzed" and "blighted" towns, to replan them, to retain the land ownership, and to dispose of land to private developers on leases not in excess of 99 years. In 1945 the Board of Trade were given powers to "steer" new factory industries to selected "Development Areas". These were all Acts of the Coalition Government. In 1946, the Labour Government passed the New Towns Act, and announced a programme of 20 new towns, to be built by public corporations financed by the Treasury. This was not much opposed and in 1947 came a Town and Country Planning Act that not only completely revises planning methods, but amounts to a revolution in land tenure. Here again the principles received all-parties support; the divisions were on the amount of compensation and the character of safeguards for property interests.

I think it is fair to say that the new legislation is designed to give the powers necessary for carrying out the policy of city reconstruction, dispersal of the "overspill" of industry and people to new towns and country towns, and preservation of green belts, advocated by the Town and Country Planning Association and endorsed by the Barlow Report of 1940. But you can trace the influence of a large number of voluntary societies who have pursued particular objects. Notable examples of this are the provision for control of outdoor advertising, for the protection of buildings of architectural and historical interest, and for the preservation of trees and woodlands. In the operation of the planning law there is no doubt that the persistently-advocated views of these and other groups will have great weight. A very important group centres on the National Council of Social Service, which is concerned with voluntary social organizations and has contributed to the popularization of "community centre" buildings and neighbourhood units. Open spaces are the concern of the National Playing Fields

Association and the Commons and Footpaths Preservation Society among others. Many other organizations could be mentioned.

Worth particular mention are the unofficial Research and Survey groups. The Land Utilization Survey, for example, conducted by Professor Dudley Stamp, which classified the agricultural land of almost the whole country, and has been of immense value, was in the main a voluntary enterprise. Economic research groups, of which the most notable is P.E.P. (Political and Economic Planning) have included research into the location of industry and other matters of importance to physical planning. These again have led the way in technique for governmental surveys.

Last, but not least, I mention briefly the innumerable local societies. Such organizations are likely to multiply now that planning is compulsory in all areas and all future development is subject to public guidance. You cannot be interested in the past or present buildings and social structure of your town or country without being interested in its future. And the local study inevitably widens out to the related region and finally to national planning policy.

The Widening Interest

In Great Britain town and country planning was, up to 1940, the interest of a few enthusiasts, who focussed their pressure on a few Ministers and politicians. The general public were oblivious to planning, though highly conscious and articulate about housing; and so were the political parties and the majority of statesmen. This narrowness of interest proved extremely injurious to the character of urban development. If the demand is merely for more houses, more quickly, no matter where, the houses will be built as nearly as possible to the point where the demand expresses itself. The bigger the town already, the more houses and the larger slice of Government subsidies it will get. And industry and business will develop fastest where housing is most active. In the vicious circle of urban expansion, public housing without public planning simply accelerates the trend.

Very resolute and very consistent propaganda was necessary by the Town and Country Planning Association to get the more intelligent sections of public opinion to understand the disastrous consequences of housing minus planning; and it took over 40 years to do it. Of course the wider public wanted planning—otherwise the new Acts would never have been introduced. Ever since the bombing of 1940-41 there has been a strong popular demand for better cities, alongside the unabated demand for houses, but the pattern and the means were only vaguely understood until the New Towns Act came in 1946 and stirred the public imagination with a concrete and dramatic project.

Publication of the plans for reconstruction of devastated areas, and the discussions of development policy, have changed the situation entirely. Not only specialized groups, but societies and organizations for many different functions and interests, are studying and debating local, regional and national planning. Religious bodies, women's institutes, chambers of commerce, Rotary Clubs, trade unions, adult education societies, even boys' and girls' clubs, form planning groups or invite speakers to explain planning. And local political parties begin to find it necessary to inquire what this planning is all about in order to decide their " line " on topical issues.

GREENBELT

MARYLAND

A group of recently completed residences.

The swimming pool in the recreation centre.

An aerial view of the Community—note the general plan and space for development.

Photos courtesy of

The National Housing Agency *and*
Emile Nadeau, Esq., M.D., D.H.P.

With so many people coming newly to a complex subject, on which it is easy to form views that omit important factors, the need of well-informed central organizations specializing on planning is not less but greater. But I think their function and methods must considerably change. It is no longer their main job, in Great Britain, to fight at the higher levels of opinion for a policy and legislation. The laws are now powerful enough. The policy accepted is substantially what the pioneer advocates wanted, and reasonably meets the demands of all responsible sections of the planning movement.

It is true that the economic crisis in Great Britain will slow down building and reconstruction, some of its

(*Continued on page 552*)

From Month to Month

News of the Institute and other Societies, Comments and Correspondence, Elections and Transfers

The Institute has been granted permission, by the Provisional British Committee of the World Engineering Conference, to reprint the following appeal for co-operative effort with respect to Community Planning. The article first appeared in the September 1947, issue of the Bulletin *of the World Engineering Conference and the author, Sir Patrick Abercrombie, needs no introduction to readers of the* Journal *as an outstanding authority on his subject.*

THE MOMENT FOR A GRAND CO-OPERATION

By SIR PATRICK ABERCROMBIE, M.A., F.R.I.B.A., M.T.P.I.

The war has caused total destruction, wide-spread damage and enhanced decay in many countries. Rebuilding of cities and restoration of the countryside on an unprecedented scale is inevitable.

In my brief *exposé,* however, I would like more particularly to direct the attention of technicians to the new urban constructions which will become necessary. Why especially new? Because in the restoration or redevelopment of existing places the future is closely, and of course, desirably rooted in the past: the Revolutionary Artists and Haussman could not escape Louis XIV!

New constructions, however, on fresh sites (so far as any site on this old earth can be called Virginal) give scope for the free use of modern technical dexterity.

Perhaps it is possible to distinguish two types of new urban constructions; (*a*) New Towns of limited size, usually the overflow from existing centres and fitted into a regional framework. (*b*) New Towns to replace totally destroyed cities whose sites are no longer convenient or healthy or which are so encumbered with debris that it would be simpler and cheaper to abandon them.

In Britain, where no town has been so destroyed that the question of an alternative site arises, we are concentrating on new towns of smaller size to relieve, in rebuilding, the centres of our larger towns which are nearly all suffering from congestion of houses and factories. We propose to build some twenty towns of approximately 60,000 inhabitants in ten years. London will have 8 or 10, Glasgow and Clyde Valley 3 or 4, Manchester and Hull one or two. When these urgent war damaged cities are dealt with, we shall proceed with the congested cities which sustained no damage. A programme of 100 such towns has been mentioned. I will not describe these New Towns: the sketch plans for several have been illustrated in the Greater London and other reports: but I may say that though small, they will in every sense be complete urban entities, though of course, fitted into a regional and national pattern.

Of the proposals to replace totally destroyed old towns on the Continent, I can say much less: but I will venture to assert that when all the visible remains of architecture, landscape and history have disappeared, it is to be questioned whether the relics are not mere trammels upon the future. Certainly there are some sites which are inevitable to any age of man: however many times destroyed, the city resurges anew. But the economic, strategic or cultural reasons for many other sites no longer persist.

What are some of the features possible for a new technical approach to these new sites? I must confine myself to a mere list of headings.

1. *Traffic*: a proper integration of means of communication by air, land and water.—In roads there is the chance of separating the functions of carrying through traffic from acting as the approach to buildings. We need increased speed and greater safety in our Towns.
2. *Community Planning*: the city is built up into a system of cells of increasing size and complexity, from the little local neighbourhood group to the Civic Centre. Here is full scope for the social co-operation which we require. Standards of Density must be laid down; a low overall density in persons per acre must be aimed at, combined with campactness in actual building.
3. *Logical Zoning*: the separation of predominant use. Here is the opportunity for the exercise of a balance between rigidity and flexibility. Control of heights and volume of building is as important as control of use.
4. *Precinctal Planning*: this grows out of the combination of Road Planning, Community Grouping and Zoning. Major precincts which emerge are for housing, industry, shopping, etc. The detailed planning of these precincts freed from the tyranny of through traffic gives much opportunity for original technical solutions.
5. *Open Space*: this aspect may be taken to include all land not actually used for buildings or transport. The two principle features of the Open Space system are, of course, Parks and Playing Fields (proportionately distributed); and the enclosing Green Belt, setting a limit to the town's growth and its Green Wedges, in which the country penetrates into the town. Natural topography here plays a dominant role.
6. *Architectural, Engineering and Landscape Design*: a coherent scheme of treatment is essential and possible on a new site. The dilemma here is the age-old one: totalitarian uniformity and anarchic individuality. The mediæval and renaissance cities achieved a balance in different but satisfactory degrees. The modern city should emulate and at least equal the past.
7. *Public Services*: a humbler approach to human comfort. Here the modern town has no need to fear rivalry with the past. Every moment of

our daily home, working and leisured life is to some extent affected by the efficiency of public services; I will only mention one direction in which new towns give immediate possibilities: district heating.

These then are some of the opportunities for combined action between Engineers of all types, Architects, Surveyors, Landscapists, and general Urbanists —all technicians whose sole object is to serve the community, using the data supplied by social worker, economist, industrialist, housing reformer. Now is the moment for a grand co-operation, in putting into practice our latest ideas.

COMMUNITY PLANNING

THE ROLE OF THE INSTITUTE AND THE ENGINEERING PROFESSION

Any person who has studied the subject of Community Planning cannot doubt that as a profession it is here to stay. Scientific planning has improved, and will continue to improve on an ever widening scale, the living conditions in and around our cities, towns and villages.

Where is the engineer in this important matter of social development? Why are so many of us, apparently, uninterested in a problem which strikes at the very foundation of our social order? What excuse can we offer for failure to assume our obligations in this respect? Do some of us concur in the suggestion that " Community planning is a passing fancy—it is all talk and no do "?

There may be some justification for such attitudes because there are not many examples of scientific planning—and more particularly of the re-planning of existing communities — which have been carried from the demonstration to the execution stage. Can it be questioned that such plans, if carried out, would better the situation?

The stumbling block is, almost invariably, local self-interest; or simply, high cost. In such matters the money can generally be found if a sufficient number of effective citizens are valiantly in support of the plan. Here the engineer can play a most prominent part. His support would add valuable weight to the argument but, unfortunately, to date, such support has, apparently, been lacking.

Engineers have not, as a rule, been active in City Council affairs and the various community groups which can and do exert pressure on the authorities. Because of the apparent lack of interest among engineers in community planning, and to stimulate interest, it was decided by the Community Planning Committee of the Institute to hold a series of conferences on this important subject and to bring the matter to the attention of the entire membership of the Institute through the medium of the *Journal.* Hence this " Community Planning " issue.

Some of the conference delegates appeared to be of the opinion that the engineer is an introvert—the type of man who works so hard with his slide-rule and his tables during the day that he has very little time for outside activities. Therefore, he has a viewpoint which does not extend beyond the restricted sphere of his own work. There is some reason to believe that this assumption is correct. This may well account for indifference to community planning—a subject in which the engineer's part is not immediately apparent. But, by training, the engineer is fitted to be a successful planner of communities.

From the purely selfish point of view alone, it is in the interest of the engineer to throw his weight behind the community planning movement. By so doing, not only will he, as a citizen and a professional man, be playing his part in making our towns, cities and rural communities immeasurably more satisfactory places in which to live—but he may be a factor in providing an inexhaustible source of work and income for men in his own, and allied, professions.

Members of the Institute's Community Planning Committee and other engineers who have an interest in the subject have been asked to present to the members their opinions on the subject.

Stewart Young, M.E.I.C., *Community Planning Branch, Saskatchewan Department of Municipal Affairs.*

I would like to restate what I have already tried to emphasize in my comments during the conference.

The engineer's interest in community development is now very great. His interest in Community Planning should be equally great but, too often, his outlook is restricted to immediate problems of the design of a sewer, laying a strip of pavement, the location of a power line, the design of a subdivision, without adequate study of the effect of the individual project on other portions of the community. In other words, if the engineer is to contribute to community planning as he should, then his outlook must be broadened to visualize each project as part of a comprehensive whole; and, otherwise all barriers toward scientific action must be removed.

Perhaps one should add that in his training, the engineer is taught that two plus two makes four. With the introduction of the human element in community planning the result may be quite different, requiring the exercise of powers other than reason—vision, imagination, forethought.

I firmly believe that the most outstanding indication derived from the National Conference is that the engineer must broaden his outlook and be prepared to look beyond the mathematical facts he is accustomed to. If the conference did not convey this directive to a majority of those present, then, in my opinion, it might as well be classed as just another meeting.

Allan K. Hay, M.E.I.C., *Superintendent and Chief Engineer, Federal District Commission, Ottawa.*

It should hardly be necessary to labor the point that the engineer should be a leader in community planning. No matter how extended the collaboration may be with architects, landscape architects, social workers and others, all such planning can only be carried out successfully when based on fundamental data provided by the engineer.

Naturally the engineer who has been trained in municipal services should above all others be in the forefront of any planning movement. As a rule he furnishes plans and surveys required in the earlier stages of an investigation, must be consulted continuously during the course of planning and in very many cases is expected to construct and operate many of the improvements which may result.

Unfortunately a life-time of dealing with elected municipal councils has often made the municipal engineer hesitant in expressing his views on planning and cynical as to any hope of large accomplishment. Too often he can look back on repeated surges of the town (now community) planning movement in his own jurisdiction, each of which was attended with much enthusiasm but each of which has left behind it little more than a beautifully printed book now gathering dust in the municipal archives.

The remedy for such a condition is generally admitted to lie in the field of public education. In the past the plans have been presented to the public with the usual fanfare of publicity, attractive printing, maps and often scale models. All of this is good but it is not enough. Such a presentation should be followed up by a continuous unremitting and effective campaign of education aimed at the tax-payer in such a way as to convince him that planning will not only pay dividends in securing him a greater return for his tax-dollar but that it is worth while even though it may necessarily over-ride certain sectional and local interests. Very few community planning schemes of any account progress far before they begin to infringe on the property rights of certain elements in the community either in the course of the construction demanded by the plan or in the operation of zoning or land-use ordinances. In the past lack of progress has often been due to this factor.

Under our democratic system of government the issue cannot be forced and it is only by an educational campaign that we can bring to bear a weight of public opinion great enough to get action. In forming and guiding such opinion the engineer should be a natural leader and as a step in this direction the recent conference under the direction of the Institute was a noteworthy event.

Ira P. Macnab, M.E.I.C., *General Manager, Public Service Commission of Halifax, N.S.*

I would like to suggest that, by reason of his training, the engineer is particularly qualified in certain aspects of planning and therefore, as a citizen he should be prepared to take an active part in any way that he can in connection with planning in his community. I think it is desirable that *The Engineering Journal* should be used as an educational medium to get this idea across to its members.

Another point which, in my opinion, is important, is that our engineering schools should stress the im-

AT THE COMMUNITY PLANNING MEETINGS

(Top) At the opening meeting. His Worship Mayor Houde, of Montreal, R. E. G. Davis, President C.P.A.C., President Grant of the Institute and Alan H. Armstrong, Secretary-Treasurer C.P.A.C.

(Centre) Part of the attentive audience listening to Leslie Williams, of New York, speaking on the subject "The Fluid City of the Future".

(Bottom, right) Geo. Mooney, of the Greater Montreal Economic Council, and Dr. Aime Cousineau, M.E.I.C., Director of the City Planning Department, Montreal.

(Bottom, left) Hugh Pomeroy, of Westchester County, N.Y., speaks at the Friday luncheon.

MORE COMMUNITY PLANNING PICTURES

(Top) The speakers at the Friday morning Session on housing; President Davis, of the C.P.A.C., presiding and, on his left, Mrs. H. L. Luffman, of Toronto.

(Centre) At the discussion on Leslie Williams' paper. The speaker is George A. McNamee, Royal Automobile Club of Canada. Mr. Williams is seated to the right of the speaker.

(Bottom, right) At the opening luncheon. The speaker is Bertram D. Tallamy, Chief Engineer N.Y. State Dept. of Public Health.

(Bottom, left) Councillor J. B. Stirling, M.E.I.C., introducing J. Alexander Walker, of Vancouver.

portance of working to a plan, not only for the present, but also for the long term view in courses given in connection with street lay-outs, sewer and water supplies, electrical distribution, etc. It seems to me that emphasis placed on these courses directing attention to the necessities of community planning would be most desirable.

One of the factors in the programme which impressed me most was the general economics involved in planning. If, as reported by the survey in Vancouver, it has been shown that the costs of services compared with the revenue through taxation in the slum areas, are so much higher than in the properly laid out livable areas, the economic aspects of this matter are important and should be given a great deal of study by engineers in laying out industrial and other works. I believe the engineer can take a useful part in eliminating present slum areas.

I was reminded again at the conference of a problem which is very much with us now and which will be increasingly with us as our living standards continue to improve—viz. the matter of urban and inter-urban transportation, parking, etc. This is a phase of planning which should be directly down the engineer's alley, and it would seem to me that our colleges could very well give a little more attention to this aspect during under-graduate courses.

Dr. Aimé Cousineau, M.E.I.C., *Director, Montreal City Planning Department.*

Community planning cannot be limited to a single profession. Many technicians in various fields have made important contributions towards the orderly and efficient growth of cities and their progress.

There are a great number of architects, landscape architects and engineers among the prominent city planning consultants in America. The city planner, to be successful, has to be above all, a specialist in co-ordination and knowing his limitations, must be prepared to call for special advice on engineering design, architecture, landscaping, etc., as applied to the layout or extension of communities. The architect, in particular, with his sense of harmony and beauty, must have some knowledge of engineering, and vice-versa the engineer with his sense of scientific knowledge and analysis of facts must possess, in order to be a successful planner, some of the characteristics of the architect.

Municipal engineers in this province, as well as in the other provinces, have great opportunities to promote and practice the science and art of city planning in its broad pattern where there is an appropriate place for every function. No headway can be expected toward the orderly disposition of land and buildings unless engineers and architects, in the exercise of their respective professional duties, become really concerned with city planning which relates to both private and public property.

It is unquestionable that the continued interest and participation of public bodies and associations such as The Engineering Institute of Canada, the Royal Architectural Institute, the Community Planning Association of Canada and the population at large, is indispensable to the planning of better cities, in gaining support for, and in aiding the official realization of such an ideal.

Jacques Gréber, M.E.I.C., *Consultant to the National Capital planning Committee and the City of Montreal.*

We all agree, in spite of natural differences of tendencies, on the general principles governing the preparation of a master plan and the study of its various parts, as it is obvious that order and harmony in the life of a community are vital necessities.

Why, then, in most countries, are the approval and the implementation of our plans so often difficult and slow to obtain? This is the point I should like to bring up to your attention.

1—In the first place, the difficulty comes from the lack of appropriate legal dispositions. Even in the countries where, like in England or in France, the legislation seems to be most advanced in regard to zoning, expropriation and protection of public property or welfare, the procedure of implementation has to be very long and uncertain.

2—Insufficient financial means, resulting in timid solutions, always inefficient and finally more costly than the comprehensive plan undertaken at once and as a whole.

3—Sometimes, through inadequate preparation of public opinion, the population seems to be uninterested, although the main object of town planning is precisely the comfort and enjoyment of the citizens.

4—Misinterpretation, either by the administration or by the general public, of the value of the operations proposed by the town planner. They seem to disregard the fact that the work involved in the plans must be carried out gradually and opportunely, according to the possibilities.

As you know, the proposals are of two or even three natures:

(a) Immediate or short range improvements—generally the easiest to be approved, for their evident emergency is often unanimously recognized.

(b) Deferred or long range proposals, those in which the town planner shows his foresight, his vision of profitable assets, those by which land values and municipal finance are boosted, those that in the course of the history of cities have always been associated with the names of great statesmen.

(c) In the same class, but more remote, are those desirable operations worth considering, but subject to revision or alteration as the time comes to carry them out.

From this last class are excluded, of course, all utopian conceptions.

A master plan, a comprehensive and complete study of the future development and harmonious life of a human agglomeration, must include those three classes of proposals. The report, or programme of recommendations must very clearly define the relative emergency, the schedule of execution, the financial ways and means permitting the gradual realization of all the proposed work, as well as the profit to be expected from it by the community as a whole and consequently by every member of the urban family.

The plans, even the best conceived, sometimes do not show with enough evidence the material profit offered to the community by appropriate street planning or widening, by developing green spaces and playgrounds, by a logical and flexible zoning, by a radical elimination of slums and the subsequent creation of new community and neighbourhood centres, and so forth.

It is therefore most desirable that the project be given extensive publicity, endorsed by booklets, exhibitions, articles in the press, lectures, comparison of similar existing and successful experiments, by financial statistics showing the increase of land values obtained by town planning improvements and all kinds of educational means, in order to convince the responsible authorities and also to create enthusiasm among the public. Our work deserves such a reward, as it is unselfish, disinterested and highly public spirited.

If good salesmanship is considered as a quality essential to the promotion of any kind of business, it is of far greater value for those whose duty it is to serve public welfare. Therefore, we must not hesitate to advertise the results of our efforts and associate the public in the pursuit of the approval of the plans.

It has been often said, that the town planner is a rare bird, an exceptional combination of the science of the engineer, the talent and inspiration of the architect, the knowledge of the physician, of the geographer, of the jurist, of the economist, the wisdom of the diplomat, the public spirit of a humanist. . . . May I also add the patience and the sacrifice of the apostle—and on top of that a smart salesman!

That is not all, for being unable by himself to be an expert in every one of these important professions, he must be, above all, unselfish and modest enough to call for the association of the best men in every one of the different sciences I have mentioned, and from such intimate and friendly teamwork a sure success can be expected.

At any rate, permit me to conclude that, in spite of its complications and difficulties, town planning is a most inspiring and fascinating profession.

PLANNING IN GREAT BRITAIN

(Continued from page 547)

man-power being directed to export and other industries. But reconstruction will go on, if at a reduced pace. What matters from the planning angle is that the pattern shall be right, whatever the speed. The problems for the administrators and advocates of planning are two. The first is that of the planning personnel and its training. The universities and professional institutes must be mainly responsible for training, but it remains necessary for public-interest societies of the widest possible composition to see that every personal and public interest is respected in the working-out of policy.

Secondly, there is the guidance and stimulation of the local organizations that must watch from the public point of view the operation of planning. It is most important that local societies, planning groups and other bodies shall be penetrated by a sufficient number of people who understand the broad principles of national and regional policy, and can relate these to local conditions, desires and ambitions. An essential part of the new national policy is that a limit of population will be set to many towns, that their competition to obtain new industries will be kept within bounds by a national guidance of location. Local authorities, for understandable reasons, tend to fight mechanically for maximum growth.

They can also help the planning authorities very effectively where they are pursuing a good policy, by making it understand and by contributing to its working out. Some new local societies or planning groups for this purpose are being formed in Great Britain, and I think many more will come. The Town and Country Planning Association is endeavouring to establish such groups in affiliation with itself, because it is felt to be most important that they should be imbued with a definite idea of the best distribution of population and industry, of the best relationship of town to country areas, and of considered standards of density and amenity. Planning in Great Britain has been made by societies who know what they want and, with every resource of information and persuasion, go out to get it.

"Planning" in itself is not a decent aim. No freedom-loving person wants to be planned. Men who want to plan others just for the sake of it ought to be transported to some remote island, to plan each other. If we plan it must be because we want something which other people will join us in wanting, and because we are satisfied ourselves and can convince others that planning is the only way to get it. In Great Britain the new planning policy has emerged from the pressures of many voluntary societies who wanted something definite, something that was demonstrably beneficial to human beings. That is why it has caught on and secured the necessary powers. Good local administration can only come from the same sources.

ELECTRICAL PROGRESS IN BRITAIN

From Britain, a country commonly considered most deficient in water power resources, comes the following.

On July 17th, the North of Scotland Hydro-Electric Board made its first issue of stock in order to fund Scottish bank advances and cover further capital expenditure that will shortly mature. The stock issue of £5,000,000 is only a small part of the total amount expected to be spent in a gigantic project which involves the construction of about seventy generating stations in northern Scotland, the selling of electricity to the industrial belt and the bringing of cheap electricity to the isolated highlands and islands.

Twenty-one major constructional schemes and several others have already been prepared for generation and distribution of hydro-electric energy and it is estimated that, within the next three years, production of electricity will approach 400,000 kilowatts.

The visitor to the Highlands of Scotland will quickly notice the engineering activity in the countryside. At Loch Sloy near historic Loch Lomond, site of the first construction scheme, more than 1,400 men are at work. A massive concrete dam 1,160 feet long and 165 feet high is being built in Glen Sloy and a 16-foot diameter tunnel is being driven through Ben Vorlich. At Tummer-Garry, Loch Fannich, Gairloch, Lochalsh, and elsewhere engineers and their men are tunneling through hills, raising huge dams, erecting power houses and stringing transmission lines.

Already the programme has reached a stage where it is having some effect on the social conditions of the people. Consumers in distribution areas are reported to be eager to avail themselves of electrical equipment, not only in their homes but in hotels, workshops and farms. By the end of 1946, 4,000 workers were employed and the plans include the housing of an eventual total of ten to fifteen thousand workers.

It will be of interest to many in Canada to note that the stated policy of the Hydro Board is not to deface the countryside and spoil it for either the local inhabitants or the tourists. To this end the services of three eminent Scottish architects have been retained to ensure that the hydro-electric works receive the best possible architectural treatment.

ATOMIC RESEARCH IN BRITAIN

Professor Cockroft, director of the British Atomic station at Hartwell recently announced that continuous atomic energy had been released in August for the first time in Britain. He stated that a uranium chain reaction had been established and that the Hartwell engine is producing enough energy to supply a large block of flats with light and power.

Professor Cockroft said that, very shortly, atomic power would be used to heat gases to 350 degrees centigrade and that 100 tons of uranium in an atomic pile could generate energy equal to 100,000 kilowatts for 20 years without fuel replacement. If the whole energy could be used, then one ton of uranium would be the equivalent of 3 million tons of coal.

HIGHWAY ACTIVITY IN NOVA SCOTIA

The Province of Nova Scotia has set the wheels in motion for a big year of road improvement in 1948. Highways Minister Merrill D. Rawding has called for tenders for 167 miles of hard surfacing next year, the biggest programme of paving undertaken since before the war.

New surfacing is planned on sections of Routes 2, 3, 4, 5, 6, 7, 8 and 10 as well as a number of heavily travelled secondary highways in continuation of the five-year highway improvement programme announced by Premier Angus L. Macdonald in 1946.

Largest single paving project is the 45-mile section of Route 6 extending from the village of Port Philip, Cumberland county, to the end of the present paving near Campbell's Bridge in Pictou county. This will provide a completely paved route along the Northumberland Strait shore via Route 21 from Oxford to Port Philip.

During the past two years a large amount of reconstruction has been undertaken in almost every part of the province in preparation for paving. Due to shortage of road-building equipment, however, many of these jobs are not yet completed but they are expected to be finished early in 1948.

ADDENDUM

Canada's North Magnetic Pole

J. M. Wardle, M.E.I.C., director of the Surveys and Engineering Branch of the Department of Mines and Resources, Ottawa, has submitted the following material as supplementary to his paper entitled "Canada's North Magnetic Pole", which appeared in the October issue of the *Journal*.

The new material results from the findings of a magnetic survey party which returned to Ottawa from the Arctic very recently.

The magnetic survey programme undertaken in the Canadian Arctic this year by Dominion Observatory scientists was of the utmost importance. A primary objective of the 1947 work was the encirclement of the supposed magnetic pole area by magnetic observations that would indicate, within fifty or one hundred miles, the pole's location. In spite of most unfavourable weather and ice conditions, magnetic observations were taken at nineteen points. Nine of these points were made through the agencies of ships in the Arctic and ten with air transportation supplied by the Royal Canadian Air Force. With much more ice than usual in the Arctic Ocean channels, and with fog very prevalent, the Royal Canadian Air Force found it necessary to fly the observers for 200 hours where ordinarily 60 hours of flying would have been sufficient. The most northerly point observed was at Eureka Sound, Latitude 80 degrees north. Serson and Clarke of the Observatory staff made the observations with air transportation, while Cummings made those with water transportation.

The results of these observations as computed to date are interesting. While observations taken up to and including 1946 indicated the pole as being on Somerset Island at Latitude 73 degrees 15 minutes, 1947 observations showed that the magnetic pole area might be anywhere in a belt extending east and west through the north parts of Somerset Island and Prince of Wales Island, but at the same latitude as computed by Madill in 1946. Thus, while the latitude of the pole seems well established, its longitude, because of anomalies in observation results, is not definitely fixed. No one area satisfies all the readings taken to date.

Variations in readings take place over a few hours. In the northern part of Prince of Wales Island, a dip reading was obtained of 89 degrees 56 minutes, which would place the point of observation some eight miles from the pole. Some three or four hours later at the same place, the dip reading was 89 degrees 20 minutes. However, all readings confirm the fact that since 1904 the north magnetic pole area has shifted northerly some 200 miles.

The 1947 results show that additional observations must be taken at points north and west of Prince of Wales and Somerset Islands to complete the magnetic encirclement of the area. If, as expected, the magnetic pole lies in the northern parts of the islands mentioned, careful magnetic surveys by ground observations will be made of this area. It is possible that there may be three areas where a maximum magnetic dip of the needle exists. In such case, the north magnetic pole for practical purposes would be the integrated effect of these poles at a distance to the south.

To assist in the daily record of magnetic variations in the north, a temporary magnetic observatory is being established at Baker Lake, Northwest Territories, and will be occupied over the coming winter by Dominion Observatory scientists. Information obtained there will supplement the Meanook, Alberta, Magnetic Observatory in furnishing control to field observations for daily variations and disturbances.

MORE ABOUT METER APPROVALS

It was reported in the September *Journal* that the National Research Council had undertaken a study of all types of electricity meters approved for use in Canada. The Council has now completed the investigation of all types approved in 1912 or earlier and has issued a list of meters on which approval will be withdrawn as of January 1st, 1948.

Lack of space prohibits the listing of all the types for which approval is to be withdrawn but interested readers may obtain the list from the Research Council by reference to file No. 17-16-6. Requests for exceptions will be considered and must be supported by submission of sample meters in accordance with the regulations governing initial approval of type.

The Standards Division, Department of Trade and Commerce, will be dealing in the near future with the question of the actual date of withdrawal of the meters from service.

A CORRECTION

The attention of the *Journal* has been drawn to the fact that the credit given by Mr. J. G. G. Kerry in his address, "The Past", in the August issue, to Mr. A. C. Dennis for the design of the Kicking Horse Pass spiral tunnels was not correctly placed. These tunnels were built after Mr. Dennis had retired from the service of the Canadian Pacific Railway and they were designed and built under the direction of Mr. John Callaghan who alone was responsible for those important works and should have been credited in this regard in Mr. Kerry's address at the Toronto meeting.

Mr. Kerry has asked us to publish this correction and to tender his apologies to Mr. Callaghan.

Mr. Dennis will be remembered for his many studies in grade reduction on the main line of the Canadian Pacific Railway and for the prominent part that he played in the design and construction of the Connaught Tunnel in Rogers Pass.

In the same address and on page 369 of the August *Journal*, Mr. Kerry credits the construction of the Quebec Bridge to Mr. Phelps Johnson and his associates of the Dominion Bridge Company. This reference was not entirely accurate in that Mr. Johnson's associates were employees of the St. Lawrence Bridge Company Limited, a special incorporation created at the joint request of the Dominion Bridge Company Limited, and of the Canadian Bridge Company Limited, and the credit for the completion of the great structure rests equally with the trained staffs of both companies. To their joint professional skill, energy and loyalty, Canada owes the erection of its most notable bridge structure.

MEETING OF COUNCIL

Minutes of a meeting of the Council of the Institute held at Headquarters on Saturday, September 20th, 1947, convening at nine thirty A.M.

Present: President L. F. Grant (Kingston) in the chair; Past-President deGaspe Beaubien (Montreal); Vice-Presidents R. S. Eadie (Montreal), G. F. Layne (Quebec), W. R. Manock (Fort Erie), and W. L. Saunders (Ottawa); Councillors J. A. Beauchemin (Montreal), P. E. Buss (Thorold), R. C. Flitton (Montreal), C. E. Gelinas (Montreal), V. Jepsen (Grand'Mere), J. H. Irvine (Ottawa), C. C. Lindsay (Montreal), V. A. McKillop (London), C. F. Morrison (Toronto), J. B. Stirling (Montreal), W. J. Thomson (Arvida), Paul Vincent (Quebec); Treasurer L. C. Jacobs (Montreal), and Assistant General Secretary W. D. Laird.

The president reported that on his recent visit to the western Ontario branches he had been fortunate enough to have with him two Ontario vice-presidents, Mr. Manock and Mr. Saunders, two past-vice-presidents in Ontario, Mr. C. E. Sisson and Mr. E. P. Muntz, and the incoming vice-president, Mr. J. A. Vance of Woodstock. In his opinion the vice-presidents are a tremendous asset to the Institute. There is a great deal they can do, which they are always willing to do and which they do very well.

General Secretary's Illness: The president reported that since the general secretary's return on August 25th from a special trip to the west, he had been confined to his home with a severe attack of multiple neuritis and had just been taken to the hospital for treatment and a complete rest. Knowing the high pressure at which the general secretary worked, and how much of himself he had given to the affairs of the Institute, the president was quite disturbed. It was not expected that he would be back at the office for several weeks. Councillors were very much concerned to receive this news and it was unanimously agreed that the president should write to Dr Wright expressing their sympathy and best wishes for his recovery. The president congratulated Mr. Laird on the excellent way he was carrying on in the general secretary's absence.

The minutes of the meeting held on June 21st, 1947, were taken as read and approved.

Business Arising From the Minutes

Ontario Provincial Division: Vice-President Manock, chairman of the Ontario Provincial Division, reported that the original draft of the proposed by-laws for the division had been circulated with a request for criticisms. Only a few minor criticisms had been received, mostly from the general secretary with a view to keeping the by-laws in line with Institute by-laws. The final draft, as submitted by the Committee on By-laws of the Division, was circulated to members present and after some discussion, on the motion of Mr. Beaubien, seconded by Mr. McKillop, it was unanimously resolved that the by-laws be approved for submission to Ontario members for their approval and for publication in the *Journal*.

Canadian Construction Association: Mr. Stirling, chairman of the Institute's Committee on Professional Interests, to which this matter had been referred, briefly reviewed the situation. He pointed out that at the annual meeting of Council in Toronto he had submitted a report which the New Developments Committee of the Canadian Construction Association were planning to bring to the attention of the Dominion and Provincial governments with a view to the forward planning of public works. The object of this planning was to prevent a recurrence of the situation in 1931-1932 when large sums of government money were spent on direct relief, with no benefit to the country except that it kept the citizens alive. The construction industry derived no benefit and the engineering profession derived no benefit. During the summer it had been difficult to get action but about a month ago a delegation from the Association had had an interview with the Rt. Hon. C. D. Howe who had admitted that the planning done by the Department of Reconstruction had been disappointing, mostly due to the provinces not having entered into the Dominion-Provincial agreements and as a result could not take advantage of the planning grants which had been offered by the Dominion government in a fairly liberal way. Mr. Howe also stated that part of the failure to get on with the planning was due to lack of technical personnel, in reply to which the delegation had suggested that the reason for this might be that the government was not offering sufficiently attractive salaries in the department of the Civil Service undertaking the work.

It was pointed out that perhaps in a month or two, or by next spring at least, the Department of Reconstruction would disappear, and Mr. Howe suggested that the provincial governments might be approached with the suggestion that they at least proceed with their own planning. The Association intends to do that, commencing with British Columbia on October 1st. Mr. Stirling hopes to accompany maritime delegations to see the Nova Scotia and New Brunswick governments at the time of the Institute Council Meeting in Halifax on October 11th.

The Institute Council has already given the Committee on Professional Interests power to act on the matter, and the committee is planning to send to the Minister a fairly strong endorsement of the action taken by the Association. He presumed that whatever the committee drafted would be satisfactory and he was planning to get something off at an early date.

Mr. Stirling's remarks were accepted as a progress report.

Community Planning Conference: Mr. Laird reviewed the situation with regard to the Institute's Conference on Community Planning which originally had been planned to take place in Toronto on November 13th and 14th. The Community Planning Association of Canada had decided to hold their annual meeting and National Conference on Community Planning in Montreal at the beginning of October and in order to avoid conflict or overlapping had asked the Institute to advance its dates to coincide with theirs. Eventually, after many conferences between the two groups, a programme has been worked out which appears to be satisfactory to everyone concerned. Mr. Laird read the programme which is now being mailed to all Institute members. He also gave a brief resume of the publicity which had been given to these meetings.

The Institute's committee still felt that engineers were not exhibiting a proper interest in community planning and had suggested "that a meeting should be arranged on Friday afternoon, October 3rd, between such members of the E.I.C. Council as are present and such E.I.C. delegates as are prepared to forego the bus tour of Montreal, to discuss and come to some conclusion as to what the Institute should do to stimulate the members at large to take an interest in community planning."

Following some discussion, it was agreed that such a meeting should be held and that a notice of the meeting should be given to all Institute Members attending the conference.

Proposed Joint Meeting with A.S.C.E.: The president reported that a letter had been received from Colonel Carey, secretary of the American Society of Civil Engineers, advising that arrangements had been completed for their summer and fall meetings for next year and that the society would not be meeting in Canada in 1948. He expressed the hope that at some future date plans for a joint meeting with the Institute could be put forward. This was noted.

Civil Service Commission Qualifications: The president reminded Council that this dealt with the question of the Civil Service regulations which at one time specified membership in the Institute as a qualification for entry into certain positions in the Civil Service. This has now been eliminated and university graduation is now specified as the sole or controlling qualification.

Since the last meeting of Council, the general secretary and Mr. MacRostie, chairman of the Institute's Committee on the Engineer in the Civil Service, had had an interview with Mr. Bland, the chairman of the Civil Service Commission, and the president read extracts from a memorandum he had received from the general secretary reporting on the interview. The situation was being reviewed in the light of the information which Mr. MacRostie and the general secretary had submitted.

In the discussion which followed it was agreed that a determined effort should be made to have Institute membership included as one of the qualifications for Civil Service employment in engineering positions, and that Mr. MacRostie be asked to take whatever further action is necessary.

Remuneration of Engineers in the Services: The president reported that a letter had been received from an Institute member, Lieut..-Col. E. M. Medlen, president of the Military Engineers Association, along the same lines as a previous letter from another member regarding the "responsibility allowance" given to doctors and dentists in the Naval Service but not given to engineers. Colonel Medlen requested that the Institute also make representations to the Minister of National Defence on behalf of military engineers.

Mr. Laird read a letter received from the Hon. Colin Gibson in response to the general secretary's letters to the Minister regarding the pay of engineers in the Naval Service. The letter reads in part as follows:

"At the time the special allowance was under review for medical and dental officers, consideration was given to making it applicable to other classes of officers in the Services, but after very careful study, it was the opinion that the particular circumstances which it was necessary to meet in the case of medical and dental officers did not exist in the same degree in the case of other officers.

"In the circumstances, I regret to have to inform you, therefore, that it is not proposed to extend this allowance to engineer officers at the present time.

The president felt that the Institute had an obligation to support its members in making representations to the Minister. He dscribed briefly past and present policies with regard to special allowances and the different conditions which existed in the case of engineer officers as compared to medical and dental officers.

Discussion followed as to what action, if any, the Institute should take. In the president's opinion it was not a case of writing letters but of securing an interview with the Minister.

Mr. Lindsay pointed out that the Institute had had a committee which had worked very hard during the war and had done a great deal towards promoting the formation of the Royal Canadian Electrical and Mechanical Engineers (R.C.E.M.E.). At that time the committee had had many interviews with the Minister of National Defence. Mr. Lindsay had been a member of that committee and he thought that the same committee would be glad to go to work again.

Mr. Eadie suggested that in reopening this question, all three services should be included, particularly as at the present time there is only one Minister.

Following further discussion it was unanimously agreed that the matter be referred to the Committee on the Engineer in the Armed Forces and that Colonel Medlen be so informed.

Report of Finance Committee

Financial Statements: It was noted that the financial statements to the end of June and to the end of July had been examined and approved.

Resignations: Mr. Eadie reported that a letter had been received from the chairman of the Membership Committee of the Montreal Branch asking that all resignations from members of that branch be held over for thirty days in order to give the committee a further opportunity to make a personal canvass. Mr. Irvine also asked that resignations from members in Ottawa be held over for further investigation. It was agreed that these resignations be held as requested.

Pensions for the Staff: Mr Eadie presented a recommendation to Council that a pension plan as proposed by the Standard Life Assurance Company for the Institute staff be established.

Following a full discussion, during which Mr. Eadie answered many questions and explained the details of the plan, it was moved by Mr. Eadie and seconded by Mr. Jacobs, that the report as submitted by the Finance Committee be adopted by this meeting of Council.

The question was raised as to whether or not the report should be adopted at this meeting without further reference to all councillors. As an amendment it was moved by Mr. Morrison and seconded by Mr. Flitton, that the report be submitted to all councillors for approval

On being put to the meeting Mr. Morrison's amendment carried, and it was decided to send a letter ballot out immediately returnable by October 8th so that final approval could be given to the plan at the meeting of Council on October 11th.

In order to save time it was agreed to record the vote of those members present at the meeting and a unanimous vote (eighteen) was recorded in favour of adopting this report.

It was unanimously agreed that a sincere vote of thanks and appreciation be extended to the members of the Finance Committee for the great amount of work which they have done in preparing and presenting this report.

Possible Overcrowding of the Engineering Profession: The president read a letter received by headquarters from the Moncton Branch pointing out that the high registration of engineering students in Canadian universities, (as noted in the December 1946 *Journal)*, will probably result in overcrowding the profession.

The letter states that disregard by the universities of the needs of the country, coupled with the admission into Canada of foreign engineers, would endanger the living standards of the members of the profession, and further suggested that the Institute should urge the universities to limit registration for engineering in the same way as medicine.

A lengthy discussion took place. The opinion was expressed that there were certain ameliorating factors which should be considered, namely—

(1) That many students now taking engineering courses do not intend to follow the profession but consider a scientific education as the best preparation for life.

(2) That employers are seeking more engineering graduates for non-engineering positions than formerly.

(3) That the industrialization of the country is providing more engineering work than formerly.

(4) That a high proportion of the membership of the profession is of an age that will free a high retirement rate in the next few years.

Attention was drawn to the replies to a questionnaire on this subject sent out by the *Financial Times*, as published in the September 13th issue.

The president said that when these considerations had been allowed for, a problem still remained, even if it was not as serious as first appeared. In 1946 the Committee on the Training and Welfare of the Young Engineer had called the attention of all deputy ministers of education to the situation but there had been little result. It was difficult for the universities to refuse registration to a young man who wanted to take an engineering course.

It was decided that the president should answer the letter of the Moncton Branch and should also refer the matter to Dr. G. R. Langley, as chairman of the Committee on the Young Engineer.

Engineers' Council for Professional Development

Fifteenth Annual Meeting: Mr. Laird outlined the programme which had been arranged for the Fifteenth Annual Meeting of the Engineers' Council for Professional Development (E.C.P.D.), which is being held at the Mount Royal Hotel, Montreal, on October 24th and 25th. The Institute is largely in the position of host. About thirty delegates have indicated that they are bringing their wives, and the Montreal Branch has very kindly undertaken to arrange entertainment for the ladies and is also arranging sight-seeing trips around the city and to the Laurentians for any of the visitors who can stay over Sunday. This progress report was noted.

Canons of Ethics for Engineers: The president referred to the revised Canons of Ethics for Engineers as recommended by the Committee on Ethics of E.C.P.D., a copy of which had been sent by the general secretary to all members of Council under date of August 5th, with a request for written comments or that they come to this meeting prepared to discuss the Canons. This revised version will be presented for adoption at the E.C.P.D. annual meeting in October and they would like to have for submission to that meeting, the approval of the Institute Council.

Mr. Laird read a letter from Dean Young, the Institute's representative on the E.C.P.D. Committee on Ethics, also a letter from Dr. Dugald Jackson, the chairman of the committee, both expressing the hope that the Institute Council would be able to give a favourable opinion in time for the annual meeting.

The point was raised as to whether or not approval of these Canons of Ethics would mean that they would supersede the Institute's Code of Ethics as adopted by the annual meeting in January 1925. Dr. Beaubien, one of the Institute's representatives on E.C.P.D., did not think approval by the Council would obligate the Institute in any way to adopt these Canons of Ethics in place of its own Code of Ethics. Following further discussion, on the motion of Dr. Beaubien, seconded by Mr. Flitton, it was unanimously agreed that the Institute Council is favourably disposed to the proposed Canons of Ethics.

Institute Representation on E.C.P.D.: The president explained that the Institute had three representatives on E.C.P.D., one retiring each year. This year, Past-President K. M. Cameron retires and is eligible for re-election, but he has expressed a desire not to be re-nominated. Past-President C. R. Young, who is also the Institute's representative on the executive committee, has signified his desire to resign as the Institute's representative on the Council and on the executive committee. This leaves as our only representative on E.C.P.D., Past-President deGaspe Beaubien.

Dr. Beaubien explained that the position on the executive committee was an extremely difficult one to fill and one for which Dean Young was admirably suited. Dean Young had done a remarkable job for the Institute and he felt that every effort should be made to have him continue. At the president's request, Mr. Laird read the letter from Dean Young in which he asked very definitely that he be relieved of his two appointments. Colonel Grant stated that he had received a personal letter from Dean Young which made it very clear that he would prefer not to continue. He was not very hopeful of getting him to reconsider but would be willing to take it up with him again if thought desirable.

Mr. Morrison stated that Dean Young had enjoyed the work very much and if he had resigned, he didn't think there was anything to be done except accept.

Following some discussion, on the motion of Dr. Beaubien, seconded by Mr. Stirling, it was unanimously resolved that Dean Young be approached to see if there is any possibility of him continuing as the Institute's representative, and, if not, that he be consulted as to his successor and that the president be empowered to approach whoever is suggested.

On the motion of Mr. Flitton, seconded by Mr. Layne, it was unanimously resolved that Mr. James A. Vance, of Woodstock, Ontario, be nominated to replace Past-President K. M. Cameron as the Institute's representative on E.C.P.D.

Committee on Student Selection and Guidance: On the motion of Dr. Beaubien, seconded by Mr. Manock, it was unanimously resolved that Dr. G. R. Langley, of Peterborough, be nominated to replace Colonel Grant as the Institute's representative on the E.C.P.D. Committee on Student Selection and Guidance.

C.I.G.R.E.: The president read a letter from Vice-President G. F. Layne advising that, in his opinion, his experience did not qualify him to represent the

Institute on the Canadian National Committee of C.I.G.R.E. (International Conference of Large Electrical Systems) and suggesting that the president might wish to make another appointment.

Following some discussion, on the motion of Mr. Layne, seconded by Mr. Beauchemin, it was unanimously agreed that E. V. Gray-Donald, General Manager of the Quebec Power Company and the Quebec Railway Light and Power Company, Quebec, be asked to represent the Institute on this committee.

The meeting adjourned for lunch at 12:30 and reconvened at 2:00 o'clock p.m. with the president in the chair.

Chemical Institute of Canada: Attention was drawn to the fact that Dr. Paul Gagnon of Quebec, a past councillor of the Institute, had been elected President of the Chemical Institute of Canada. It was unanimously agreed that a letter of congratulation should be sent to Dr. Gagnon from the Council.

Ernest Marceau and Phelps Johnston Prizes: Mr. Eadie pointed out that as chairman of the examiners for the Phelps Johnston prize he would like the advice of Council on the eligibility of certain papers for this prize.

The prize rules state that the Phelps Johnston prize is "For an English Student", and the Ernest Marceau prize is "For a French Student". This year, Mr. Eadie has received three papers written in English by French students at the Ecole Polytechnique and the question has arisen as to whether these papers are eligible for the Phelps Johnston or the Ernest Marceau prize.

Following a full discussion, on the motion of Mr. Jacobs, seconded by Mr. Vincent, it was unanimously resolved that papers for the Phelps Johnston prize be restricted to papers written in English and that the papers for the Ernest Marceau prize be restricted to papers written in French, irrespective of the racial origin of the candidate but with the understanding that the same paper cannot be submitted in two languages and be eligible for the two prizes.

Councillor for the Moncton Branch: On the recommendation of the Moncton Branch, it was unanimously resolved that Mr. W. C. MacDonald be appointed to complete the term of Mr. H. W. Hole as councillor for the Moncton Branch. Mr. Hole is leaving this Fall for England and he has submitted his resignation as a Member of the Institute.

Report of Nominating Committee: Mr. Laird read the report from the Nominating Committee from which it was noted that the name of a presidential nominee was not included. This nomination, the committee hopes to be able to submit shortly.

Mr. Vincent drew attention to the fact that Rene Dupuis, the Quebec Branch nominee for councillor, had moved to the Montreal district and there would probably be a change in the nomination from the Quebec Branch. On the motion of Mr. Vincent, seconded by Mr. Lindsay, it was unanimously resolved that the list of nominees be approved as received, but that the Quebec Branch nomination be left open for a substitution. It was agreed that that nomination and the nomination for president should come before the October meeting of Council for approval. The list of nominees was published in the October issue of *The Engineering Journal.*

Joint Finance Committee in Alberta: On the recommendation of the Edmonton Branch, it was unanimously resolved that J. E. Cranswick and J. W. Porteous be appointed as the Institute's representatives on the Joint Finance Committee in Alberta.

Presidential Visit to Branches: The president reported that during the first week of September he had visited the London, Border Cities, Sarnia, Sault Ste. Marie and Hamilton Branches. The kindness and hospitality received at all branches had been inspiring. In talking to the branches, the President had emphasized the necessity of co-operation between the Institute and the Association of Professional Engineers of Ontario. About 90 per cent of the members are members of both organizations and the president felt that in speaking as a member of the Institute, members should not fail to put in a good word for the Association, and when speaking as a member of the Association, boost the Institute. He also spoke on "What the Institute could do for the engineer, and what the engineer could do for the Institute".

The president will be paying his official visit to the Montreal Branch at their opening meeting on October 1st. He will be leaving for a two weeks tour of the Maritime Branches on October 4th; will visit the Peterborough Branch on November 5th, the Saint Maurice Valley Branch on November 27th, and the Quebec Branch on November 28th, when that branch is celebrating its 40th anniversary. He is planning to visit the western branches next spring, finishing up at the annual meeting in Banff.

Conservation of Canada's Natural Resources: Mr. Laird reported that Mr. Fraser Keith had suggested that the Institute might take some action, possibly by the appointment of a committee on which he thought Mr. Keith would be willing to serve, to further the development and conservation of Canada's natural resources. One of the aims of the Institute as recorded in the by-laws is, "to encourage original research, and the study, development and conservation of the resources of the Dominion".

Following some discussion, during which the importance of the suggestion was recognized, on the motion of Mr. Eadie, seconded by Mr. Stirling, it was agreed that Mr. Keith be advised that Council had received his suggestion with interest and would be glad to receive a letter giving further details with particular reference to the scope of the proposed committee's activities.

Library and House Committee: Mr. Flitton, chairman of the Library and House Committee, reported that his committee has been giving considerable thought to the inadequacy of the present Headquarters building and has been considering several proposals for alterations. One member of the committee has now submitted a set of preliminary plans for the construction of a new building on the site of the old building, the result of which would be something suitable as a Headquarters for the Institute for many years to come. The committee is studying these plans and expects to submit a report to Council in the near future. This progress report was noted.

Future Council Meetings: It was noted that the next meeting of Council would be held in Halifax on October the 11th, during the president's tour of the Maritime branches, and that the November meeting would be held in Quebec City on November the 29th, the day following the president's official visit to the Quebec Branch, which is this year celebrating its fortieth anniversary.

The Council rose at three-thirty p.m.

W. D. Laird, *Assistant General Secretary.*

ELECTIONS AND TRANSFERS

At a meeting of Council held at Halifax, N.S., October 11th, the following Elections and Transfers were effected:

Members

Bews, Kenneth Francombe, B.Sc., (Mech.), Queen's, plant engr., Kenwood Mills Ltd., Arnprior, Ont.
Boehm, Carl Rice, Colonel, R.C.E.M.E., B.A.Sc., Toronto, Deputy Director of Mech. Engrg., Army H.Q., Ottawa, Ont.
Cunningham, James Baker, B.Sc., (Mech.); M.Sc., (Fuel Engrg.), Virginia Poly. Institute, mech. engr., Canadian Locomotive Co. Ltd., Kingston, Ont.
Demarque, Geoffroy Marie, Ingenieur des Constructions civiles, Ecole Nationale des Ponts et Chaussees, Paris, France, Mount Enterprise Ltd., Montreal, Que.
Krzemieniewski, Jozef, M.Sc., (Chem. Engrg.), Lwow Univ., Lwow, Poland, Robert A. Rankin Co., Ltd., Cornwall, Ont.
Nash, Charles Wood, B.Sc., (Civil), Washington State College, managing-director, Highway Construction Co. Ltd., Vancouver, B.C.
Pinn, Philip William, B.Sc., (Elect.), Manitoba, elect. engr., C. D. Howe Co., Ltd., Port Arthur, Ont.
Saunders, George Oaten, B.Sc., (Mech.), Queen's, asst. mtce. engr., Canadian Locomotive Co., Ltd., Kingston, Ont.
Snelgrove, William Henry, B.Eng., (Mech.), McGill, prod. mgr., i/c engrg., Pepsi-Cola Co. of Canada Ltd., Montreal, Que.
Southam, William Watson, B.A.Sc., (Elect.), McGill, executive asst., production, The Southam Co. Ltd., Montreal, Que.
Tobias, Alexander, chief engineer, Standard Iron & Steel Works Limited, Toronto, Ont.
Young, Stephen M., B.Eng., (Mech.); M.Sc., (Mech.), Saskatchewan, chief engr., International Harvester Co., Hamilton, Ont.

Juniors

Gagliardi, Samuel, B.A.Sc., (Mech.), British Columbia, 47 Rosemount Ave., Montreal, Que.
Poyser, Lindsay Earl, B.Sc., (Elect.), Manitoba, laboratory demonstrator, Univ. of Manitoba, Winnipeg, Man.
Sharpe, Alan Lloyd, B.Sc., (Mech.), Queen's, jr. engr., diesel divn., Dominion Engineering Ltd., Lachine, Que.
Shorter, Gordon William Erskine, B.A.Sc., (Mech.), Toronto, A. E. Shorter & Son, Ottawa, Ont.

Affiliate

Drummond, Robert, managing director, A. W. Robertson Ltd. Toronto, Ont.

Admitted as Students

Allan, William Gordon, McGill, 25 Fenwick Ave., Montreal West, Que.
Bloomer, Julian Cyril Scott, Nova Scotia Tech. College, Halifax, N.S.
Buck, John Martin, McGill, 3975 Claude St., Verdun, Que.
Clark, Lawrence Wilfred, New Brunswick, Beaverbrook Residence, Fredericton, N.B.
Cooke, Douglas Wallace, New Brunswick, Beaverbrook Res., Fredericton, N.B.
Dalton, Eric Leslie, Nova Scotia Tech. College, Halifax, N.S.
Dunn, Richard Herbert, McGill, 7130 Chambord St., Montreal, Que.
Gerrior, Leo Joseph, Nova Scotia Tech. College, Halifax, N.S.
Gey, Ralph Norman, McGill, 6 Weredale Park, Westmount, Que.
Harriott, Lennox, New Brunswick, 38 Waterloo Row, Fredericton, N.B.
Hicks, George Hartley, New Brunswick, 163 Aberdeen St., Fredericton, N.B.
Howell, Allison Brant, McGill, 3681 Hutchison St., Montreal, Que.
Johnson, William Neil Venables, New Brunswick, Fredericton, N.B.
Lefebvre, J. Guy, McGill, Peterson Residence, Lachine, Que.
McCormick, Edward Douglas, New Brunswick, Beaverbrook Res., Fredericton, N.B.
McGibbon, Charles Mason, Nova Scotia Tech. College, Halifax, N.S.
McNevan, Archibald Malcolm, New Brunswick, Pennfield, N.B.
Nelson, Allan Roedler, McGill, 3683 Hutchison St., Montreal, Que.
Paine, Edward Earl, McGill, 211 Kindersley Ave., Town of Mt. Royal, Que.
Sawyer, Douglas Everett, Nova Scotia Tech. College, Halifax, N.S.
Smith, George Leighton, New Brunswick, 161 Argyle St., Fredericton, N.B.
Stairs, Denis Webb, McGill, 841 Lexington Ave., Montreal, Que.
Williams, Charles Mecum, McGill, Macdonald College P.O., Que.

Applications through Associations: By virtue of the cooperative agreements between the Institute and the associations of professional engineers, the following elections and transfers have become effective:

Saskatchewan

Member

Parres, James Christopher, B.Sc., (geology), Saskatchewan, consultg. geologist, Flin Flon, Man.

Student to Junior

McIntyre, Duncan, B.Sc., (Civil), Saskatchewan, jr. engr., P.F.R.A., Regina, Sask.
Wenhardt, Ernest Walter, B.Eng., (Civil), Saskatchewan, P.F.R.A., Regina, Sask.

New Brunswick

Member

Wilson, Cyril T. R., B.Sc., (Elect.), Nova Scotia Tech. College, asst. genl. mgr., N.B. Oilfields, Moncton, N.B.

Junior to Member

Beattie, Ira MacIntosh, B.Sc., (Civil), New Brunswick, Professor of Civil Engineering, Univ. of New Brunswick, N.B.

Quebec

Member

Parent, Douglas, B.Sc., (Mining), New Mexico School of Mines, mine manager, Buffadison Gold Mines Limited, Val d'Or, Que.

Personals

News of the Personal Activities of members of the Institute

The Hon. Grote Stirling, HON.M.E.I.C., who has represented the federal riding of Yale, B.C., for the past 23 years in the House of Commons, has been forced to resign due to ill health. Returning to Kelowna, B.C., after the last session, Mr. Stirling was advised by his physician to retire from active politics.

A. W. Connor, M.E.I.C., consulting civil engineer, Toronto, Ont., will retire from active practice after fifty years in engineering. Mr. Connor graduated in arts in 1893, and in engineering in 1895 at Toronto University. He specialized in rigid frame construction and is widely known throughout the construction industry.

J. M. Wardle, M.E.I.C., heretofore director of the Surveys and Engineering Branch of the Department of Mines and Resources, Ottawa, in view of the recent reorganization of the Department, now becomes associated directly with the Deputy Minister's office as director of special projects. In addition to supervising certain major construction projects, he will represent the Department on a number of boards and commissions, including, among others, the Eastern Rockies Forest Conservation Board, the International Boundary Commission and the Northwest Territories Power Commission which is shortly to be established. The Department's three technical Branches—Mines and Geology; Lands, Parks and Forests; and Surveys and Engineering—have been abolished and replaced by two branches designated as Mines, Forests and Scientific Services Branch; and Lands and Development Services Branch.

C. A. Morrison, M.E.I.C., formerly district manager at Halifax, N.S., for Canadian General Electric Company has assumed the same position in Vancouver, B.C. He is a graduate in electrical engineering from the University of Toronto, 1927, and was a member of its faculty for a number of years. He went to the C.G.E. head office in 1930 as a lighting service engineer. Since that time he has served for a number of years in the Montreal office, going to Halifax as district manager in 1945.

Major K. R. Ward, M.E.I.C., is at present with the Canadian Army Liaison Establishment in London, England, where he is employed as a technical liaison officer.

S. R. Banks, M.E.I.C.

The Hon. Grote Stirling, Hon. M.E.I.C.

Charles Miller, M.E.I.C.

W. C. MacDonald, M.E.I.C., has been elected to represent the Saint John Branch on the Council of the Institute for the years 1947-1948. Born in Shelbourne, N.S., he studied at Dalhousie College, Halifax, and worked first for the National Transcontinental Railway at Edmundston, N.B., as an instrumentman. In 1912 and 1913 he was resident engineer for that organization at Edmundston, and he transferred to the Canadian Pacific Railway in 1913 as resident engineer at Sudbury, Ont. He came to Montreal in 1914, to a position as engineer with the Cook Construction Company. In 1916 he joined Kennedy and MacDonald Company to work as engineer and accountant for the construction of the Saint John-Quebec Railway. He was later associated with the Bedford Construction Company Limited. He was secretary-treasurer in Montreal, and in Jamaica, B.W.I., for La Societé Génerale de Ponts et Chaussées Limitée, for a time, and he practised privately at Kingston, Jamaica, for several years. He returned to New Brunswick in 1937, joining the Department of Public Works as a highway engineer. He is now district airway engineer at Moncton, N.B., for the civil aviation division of the Department of Transport.

Charles Miller, M.E.I.C., is no longer with Beauharnois Light Heat and Power Company. He has accepted the appointment as chief hydraulic engineer for the Ontario Paper Company Limited at Thorold, Ont. He was general superintendent for the Beauharnois Company from November 1946, when he was promoted from assistant general superintendent.

G. W. Cummings, M.E.I.C., has set up a structural engineering practice in St. Johns, Nfld., He is a civil engineering graduate of Nova Scotia Technical College, class of 1944. He was associated with his father's contracting business in St. Johns, for a time. He later worked for Earle Sons and Company Limited at Fogo, Nfld., and has been in Toronto where he did marine and foundation work for Russell Construction Company Limited.

E. C. Williams, M.E.I.C., formerly special assistant to the works manager, of Canadian General Electric Company Limited at Peterborough, Ont., has been appointed manager of the newly created Switchgear Division at the Peterborough Works. He came from Australia and New Zealand to the company's test course and has served in various capacities at Peterborough and at the company's head office in Toronto.

J. H. C. Maclure, M.E.I.C., has rejoined Canadian Fairbanks Morse Company Limited as engineer in the Saint John Branch, specializing in engine, pump, and electrical work. He is a civil engineering graduate of McGill University, Montreal, class of 1944. In 1945 he was on a special assignment for 12 months to Douglas Aircraft Company, Santa Monica, Calif., as stress analyst and he worked later on hydraulic design in connection with the C-54 transport plane.

S. R. Banks, M.E.I.C., the former chairman of the Programme Committee of the Montreal Branch of the Institute, was transferred to England in August last by Aluminium Laboratories Limited. He is located at Banbury, Oxon, England, and is in charge of the structural engineering work of the development division of Aluminium Laboratories Limited in Great Britain. Mr. Banks went to Aluminum Company of Canada Limited, Montreal, in 1940, and was engaged on design of works involved in the company's wartime building programme. He transferred to Aluminium Laboratories Limited, Montreal, in 1944.

J. D. Adams, Jr.E.I.C., of London, Ont., is appointed county road superintendent and engineer of Carlton County, Ont. He is a McGill graduate, class of 1939, with a B.Eng. degree. He was with Dominion Bridge Company, Lachine, Que., for several years, and served with the R.C.E.

R. C. Bryce, Jr.E.I.C., is on leave of absence from Dominion Engineering Works, Montreal, and is taking a course in industrial relations at Queen's University, Kingston. He joined Dominion Engineering Works in 1946 after serving for three years in the R.C.N.V.R. with the rank of lieutenant. He is a graduate in mechanical engineering from the University of Saskatchewan, 1942.

J. O. Kelly, Jr.E.I.C., has accepted a position with the Consolidated Paper Corporation Limited at Shawinigan Falls, Que., as assistant control superintendent. He is a McGill University graduate with the degree of B.Eng., chemical, and was recently discharged from the R.C.E.M.E.

R. Bouthillette, S.E.I.C., is a graduate student at Illinois Institute of Technology, studying for a masters degree in mechanical engineering. He received a B.A.Sc. degree in civil engineering at Ecole Polytechnique, Montreal, in 1946, and was on the staff of the Ecole during the year 1946-47.

W. J. C. Gall, S.E.I.C., is working on a doctorate at the Swiss Federal Institute of Technology, Zurich, on a physical-chemical theme in connection with the large screen television apparatus being developed there. In July he was successful in obtaining the first scholarship of the newly arranged Swiss-Canadian Student Exchange. In September he went to Alpbach, near Innsbruck, Austria, as the sole Canadian representative, and one of the six from America, to the "Third International Austrian College", which included about 250 professors and students from about fifteen countries. Following this, he and four British students were guests of Austrian students in Vienna. Mr. Gall received the degree of B.A.Sc. in chemical engineering at University of Toronto in 1946.

G. M. Genge, S.E.I.C., who graduated from the University of British Columbia this year, with the degree of B.A.Sc., is now at Whittier, Alaska, with the Alaska Builders' Corporation. He expects to be going in January 1948 to a project in Guatemala, Central America.

B. J. Morrow, S.E.I.C., who obtained the B.Eng. degree in chemical engineering at McGill University last May, has been awarded a research assistantship in the department of chemical engineering at Princeton University, where he will continue his studies.

Obituaries

The sympathy of the Institute is extended to the relatives of those whose passing is recorded here.

Gordon Grant, M.E.I.C., well-known Canadian railroad construction engineer, passed away on September 27th. 1947, at his home in Toronto. The outstanding work with which he was identified as chief engineer was the building and construction of the National Transcontinental Railway from Moncton, N.B., to Winnipeg, Man. For years prior to his appointment to the above post he had worked on location and construction of the Canadian Pacific Railway.

Born at Dufftown, Banffshire, Scotland, in 1865. he came to Canada in 1872 and graduated from the Ottawa University in 1881. He entered railway work immediately, going to the Buenos Aires and Rosario Railway in Argentina in 1882. From 1887 to 1890 he was employed on the construction of the Cape Breton Railway and in 1890 to 1893 he was assistant engineer in the chief engineer's office of the Canadian Pacific Railway. He went to Florida in 1893 to be engineer on the construction of the Jacksonville and Indian Railway. In 1896 he was assistant engineer for a deep waterways canal survey for the Dominion Government and in 1897 to 1900 he worked on surveys for the Crow's Nest Pass Railway and the Arrowhead and Kootenay Railway in British Columbia. He was then chief draughtsman in the C.P.R. construction department for a time and he joined the National Transcontinental Railway in 1906 as assistant district engineer. He had become chief engineer for that organization when he transferred to the Department of Railways and Canals of the Dominion Government in 1924. He entered the Canadian National Railways in 1925 remaining until his retirement in 1933.

Mr. Grant joined the Institute in 1898 as an Associate Member, transferring to Member in 1906. He was awarded Life Membership in December 1932.

Robert Strickland, M.E.I.C., of Ste. Anne de Bellevue, Que., died on July 15th, 1947.

Mr. Strickland was born in Yorkshire, England, in 1874, and served an apprenticeship with the engineering firm of R. Roger and Company, Stockton-on-Tees. He was employed as an assistant engineer in 1895 by Messrs. Clarke Chapman and Company at Gateshead-on-Tyne, and was appointed a marine engineer in 1897. In Natal, South Africa, he was assistant engineer on the surveys and construction of the Natal Government Railway from 1900 to 1903.

Coming to Canada in 1905, he received employment on the survey of the National Transcontinental Railway, and he worked later on the Quebec-Saguenay Railway construction. For some years he was a partner in the shipping and broking firm, Cann and Strickland, in St. Johns, Que. He was associated later with the Beauharnois Construction Company at Beauharnois, Que., and with the Foundation Company of Canada Limited, Montreal. He was inactive for several years before his death.

Mr. Strickland joined the Institute as an Associate Member in 1906, transferred to Member in 1940. He was awarded Life Membership in 1946.

J. E. Openshaw, M.E.I.C., M.B.E., of Montreal, Que., died recently. Born at Bury. Lancs., England, in 1887, he studied at the University of Liverpool, England, receiving a bachelor of engineering degree with honors in 1908. In Canada he attended McGill University, Montreal, receiving a bachelor of science degree in 1910, with honors in bridge design.

Joining Dominion Bridge Company, Lachine, Que., that year, he worked on design, detailing, and inspection of spans for the Canadian Pacific Railway bridge at Lachine.

He served in the first World War as a lieutenant in the army, and on his return established the firm of Openshaw and Bennet Limited in Montreal. He was president of the firm until his death this summer. Mr. Openshaw was honored in 1943 with the M.B.E. decoration. He joined the Institute in 1909 as a Student, transferring to Associate Member in 1913 and to Member in 1940.

Frederick Blair Reid, M.E.I.C., for many years an engineer with the Geodetic Surveys Branch of the Department of Mines and Resources and for 40 years a resident of Ottawa, Ont., died on September 20th, 1947, after a lengthy illness.

Born at Bowmanville, Ont., in 1883, he was a graduate of the University of Toronto, class of 1904. For three years he was on the staff of Willis Chipman, C.E., of Toronto, doing field and office work and design of waterworks and sewerage systems. He was resident engineer in charge of installation of water works at Port Elgin and Thorold, Ont., and the sewerage system at Brampton, Ont. He joined the Geodetic Service of Canada in 1908, when it was still part of the organization of the Department of the Interior. He was then placed in charge of a precise levelling party, and was later appointed supervisor of levelling. He qualified as a Dominion Land Surveyor early in his career.

Mr. Reid joined the Institute in 1919 as a Member.

H. M. Barton, M.E.I.C., died on October 18th in hospital in Ottawa, Ont., after a lengthy illness. He had been for many years with the Geodetic Surveys Branch of the Department of Mines and Resources, Ottawa.

Born at Croydon, England, in 1883, he studied at the Crystal Palace School of Engineering, graduating in 1904. He worked for three years as assistant engineer on the Harbour Works at Durban, Natal, South Africa. Arriving in Canada in 1908, he joined the Geodetic Survey. He was first employed as a recorder on a precise levelling party, and later was in charge of reconnaissance and recording on various projects. In 1912, after qualifying as a Dominion Land Surveyor, he was in charge of triangulation in the field for a section of the international boundary survey. He remained with the department as a geodetic engineer until his retirement several years ago.

Mr. Barton served overseas with the C.A.S.C. in the first World War, with the rank of lieutenant. He jonied the Institute in 1921 as an Associate Member, transferring to Member in 1940. He was an active member of the Ottawa Branch, having served in 1930 on the committee making arrangements for the Institute's Annual Meeting.

News of the Branches

Activities of the Twenty-eight Branches of the Institute and abstracts of papers presented

CALGARY BRANCH

J. F. Langston, M.E.I.C. - - - - *Secretary-Treasurer*
T. M. Parry, M.E.I.C. - - - - - *Branch News Editor*

Fall activities of the Calgary branch commenced with a general meeting on Thursday, October 2.

In his opening remarks Chairman M. W. Jennings pointed out that the branch members faced a busy season with the annual general meeting slated for Banff next summer. All members should stand ready to accept any assignment they might be asked to carry on the various special committees which would have to be set up.

A number of new members were present and these, upon request of the chairman, introduced themselves to the gathering.

J. H. Palmason, general manager of the prairie division, Dominion Tar and Chemical Co. Ltd., then presented an interesting paper on wood preservation.

Opening with a brief account of his company's activities throughout the country, Mr. Palmason dealt with the various phases pertinent to an understanding of the treatment and uses of creosoted wood products.

Creosote has been recognized as a highly toxic and enduring wood preservative for over 100 years. It is manufactured by distilling the coal tars produced by coking plants. Because of its sources, it is largely dependent on the coal and steel industries.

Railway ties, piling, telephone and power poles constitute the more important materials treated. Treatment consists of replacing the moisture in the outer cells, or sapwood with the treating oil. This is done either by the "Hot and Cold Oil Process" for the butt treatment of cedar poles, or the pressure processes by which 90 per cent of the volume of all treating is done. The various technical aspects of butt treatment and the three main methods of pressure treatment were explained by the speaker, using a number of large illustrations.

Mr. Palmason gave some interesting statistics. In 1946, the

Company used 10 million gallons of creosote and 7½ million gallons of fuel oil. Five and a half million ties were treated. The two transcontinental railways together save over $10 million annually by using treated ties.

A hearty vote of thanks to the speaker for his interesting presentation was moved by Past-chairman Harry Younger. Present were 53 members and 10 visitors.

CAPE BRETON BRANCH

S. G. Naish, M.E.I.C. - - - *Secretary-Treasurer*

On October 6th the Cape Breton Branch had the pleasure of a visit from President L. F. Grant and Mrs. Grant. Colonel J. A. Macdonald and Secretary-Treasurer S. G. Naish met the presidential party on its arrival in the morning. In the afternoon, C. M. Anson, General Manager of the Dominion Steel & Coal Corp. Ltd., made arrangements for them to visit the Sydney Steel Plant.

In the evening a dinner meeting was held, presided over by Branch Chairman Colonel J. A. Macdonald, at which President Grant gave an amusing and comprehensive address covering Institute news and developments. At the end of his talk, President Grant asked for any comments as to how Headquarters could be more useful.

Participating in the discussion which followed were W. S. Wilson, M. Cossitt, N. Parlee, J. Morrison and S. G. Naish. A vote of thanks to the President for coming was moved and seconded by Vice President (for the Maritimes) C. M. Anson and Councillor S. C. Mifflen, respectively.

On the morning of October 7th the President went underground at 1B Colliery of the Dominion Coal Company and inspected the workings under the guidance of Councillor S. C. Mifflen.

On the morning of October 8th, President and Mrs. Grant drove to Antigonish in company with Mr. and Mrs. C. M. Anson, S. C. Mifflen and S. G. Naish. They were welcomed on arrival by Rev. Father W. P. Fogarty, Professor of Engineering, and Professor D. MacNeil of the Department of Mining. At luncheon the presidential party were the guests of Dr. P. J. Nicholson, Rector, and the Faculty of St. Francis Xavier University in Morrison Hall.

In the afternoon, President Grant addressed the engineering students under the chairmanship of Rev. Father W. P. Fogarty, and received an enthusiastic welcome. He was followed by Vice-President C. M. Ansen, who gave a dramatic account of the installation of a new blooming mill at the Sydney Steel Plants, as an example of the life an engineer might be expected to lead.

Afterwards the President and Mrs. Grant and Vice-President Anson left by automobile for Halifax. The unofficial comment of the Cape Breton Branch was that President Grant's visit had been one of the most successful for many years, and that his trip has done much to strengthen the profession in this territory.

The president in one of the less technical moments of his Maritimes Tour.

LETHBRIDGE BRANCH

Thomas Miard, M.E.I.C. - - - *Secretary-Treasurer*
J. A. Haberman, S.E.I.C. - - - *Branch News Editor*

Reduce the number of customer outages, increase customer satisfaction and good will, give greater operating revenue to the Utility, reduce the cost of repairs and provide greater safety to the line repair crews by more refinement in the system of operation. One such refinement is obtained by **Fault Selective Protection on Distribution Systems.**

On Monday, September 29th, 1947, M. C. Code, distribution engineer for Canadian General Electric outlined the uses of Fault Selective Protection to a group of 58 attending a dinner meeting of the Lethbridge Branch of the Institute at the Marquis Hotel.

"Faults in power systems are generally one of two types", said Mr. Code, "the transient and the persistent". Transient or momentary faults such as caused by electrical storms, winds, or momentary short circuits are far more frequent than persistent faults. They account for 85 or 90 per cent of all faults, and should be cleared from the system with the least possible delay. When a persistent fault occurs in a distribution circuit it is generally necessary to amputate that branch without too long interruptions in the remainder of the system.

By carefully planned arrangement and selection of fuses, and cutouts perfectly co-ordinated with master tripping relays and circuit breakers the system can be designed to function more efficiently and service restored with a minimum of inconvenience to the customer.

Mr. Code with the help of an elaborate model of a power distribution system outlined the functioning of such a well planned protective arrangement. He demonstrated by manipulation of fuses and circuit breakers how faults and power interruption could be reduced or even eliminated.

The meeting was opened with the former Chairman R. S. Lawrence presiding. Mr. Lawrence introduced A. G. Donaldson and turned over the gavel to him as the incoming chairman.

Mr. Somerville introduced all visitors present, and R. S. Towsdale introduced the guest speaker to the meeting.

MONCTON BRANCH

V. C. Blackett, M.E.I.C. - - - *Secretary-Treasurer*

On October 14th members of Moncton Branch, and their ladies, had the privilege of entertaining President L. F. Grant and Mrs. Grant at a dinner meeting held in the Beaver Club Curling Rink.

Before the speakers were called upon, T. H. Dickson made special reference to the late E. R. Evans, immediate past-chairman and councillor-elect of Moncton Branch. A minute's silence was observed in memory of Mr. Evans.

At the request of Chairman A. R. Bennett, past-president Dean McKiel introduced President Grant. In his opening remarks the President emphasized the many services The Engineering Institute had made available to the membership, and urged that members should do all possible for the Institute, especially in contributing technical papers to the *Engineering Journal.*

Paying tribute to the Canadian engineer, the President said one could not travel from one end of Canada to the other without a feeling of pride at what had been accomplished.

Reference was made to the abnormally high registration in Canadian engineering colleges, a matter that had recently been brought to the attention of Council by Moncton Branch Executive. The danger of overcrowding the Profession and the hazard of unemployment, said the President, had been lessened by the stepped-up industrial capacity of the nation and the resulting increased opportunities for engineers. Retirement of older engineers and the acceptance by young graduates of non-engineering positions would also help.

G. L. Dickson, past vice-president, in referring to the overcrowding of engineering classes, and the possibility that the employment situation might be eased by engineers taking non-engineering positions, said, although some may give up engineering voluntarily, others will probably be starved out.

B. E. Bayne and A. S. Gunn also spoke briefly on various aspects of the student problem.

During the course of the dinner a violin selection was played by James G. Davis.

The meeting closed with the singing of the National Anthem.

MONTREAL BRANCH

A. C. Abbott, M.E.I.C. - - - *Branch News Editor*

The following is the Membership for the Nominating Committee for 1947:

J. M. Crawford, E. Van Koughnet, appointed by the Executive Committee. H. F. Finnemore, J. F. Plow, I. Brouillet, elected by members October the 1st, 1947.

At a meeting of the Committee held on October the 7th, H. F. Finnemore was elected Chairman.

Mention has already been made of the intention to hold a Dance instead of the usual Smoker. Plans are now going ahead and the Ball Room of the Mount Royal Hotel has been reserved for the evening of February the 13th, 1948. Members are requested to keep this date in mind and to purchase their tickets as soon as they become available. A good turn-out is expected.

Those attending Paper Nights recently will have noticed marked improvement in the ventilation of the Auditorium. Other improvements which have recently been carried out at Headquarters include redecoration, and a more liberal supply of coat hangers.

We wish to draw the attention of members to the fact that a librarian will be on duty each evening until 6.00 p.m. and on Thursday nights when papers are being given until 8.00 p.m. Due to congested conditions it is not practical to permit members to enter the stacks.

Due to difficulties in publishing the September issue of the *Journal*, the announcement regarding the opening night was unfortunately of little value. However, some 300 were in attendance and favourable comments were heard regarding the arrangements made to get the members better acquainted with one another. The Entertainment Committee under the chairmanship of R. H. Hobner, are to be congratulated on an excellent job. President Grant gave an inspiring address which was followed by the presentation of student prizes. Dr. Huet Massue showed slides illustrating the growth in membership and pointed out that there were many graduates of engineering in recent years who had not applied for membership in the Institute. The results of Dr. Massue's study indicate that active steps must be taken to interest all engineers who are eligible for membership, if the Institute is to continue to grow. Dr. Massue deserves the thanks of all those interested in Institute Affairs, for brniging this matter to light so graphically.

Junior Section

On Monday, October 6th, the Junior Section opened its activities for the 1947-48 season by having F. W. Bruce, vice-president and sales manager of the Aluminum Company of Canada, as guest speaker. More than 170 members heard Mr. Bruce lay emphasis to the young engineers on **The Importance of Selling to the Engineer.** Mr. Bruce's account of his vast experience at the head of the sales department of the Aluminum Company was certainly of great profit to the junior members, who can now understand how much sales departments were in need of engineers and why engineers should not scorn opportunities as sales engineers.

We were very fortunate in hearing Colonel Baird and Mr. G. J. Klein at our regular meeting of October 20th, on **"Snow and Ice Research in Canada"** with particular reference to engineering problems encountered on Exercise Musk-Ox. Colonel Baird who commanded the Exercise was well qualified to state the problems to be solved each year by the Canadian population when snow sets in. The fact that most of the Canadian soil is covered with snow more than six months every year should be a sufficient indication for Canadian engineers to direct their research toward that field. Colonel Baird and Mr. Klein have been working together in that particular field for several years.

Junior members are reminded that the Annual Meeting of the Junior Section will be held on January 26th, 1948. On that night, new officers for 1948 will be elected. All nominations, supported by five members, must be in the hands of the Secretary-Treasurer before December 1st.

NIAGARA PENINSULA BRANCH

P. A. Pasquet, Jr.E.I.C. - - - *Secretary-Treasurer*
C. A. O. Dell, M.E.I.C. - - - *Branch News Editor*

On September 17th the members of the Niagara Peninsula Branch visited the DeCew Falls generating station of the Hydro-Electric Power Commission of Ontario, where a new 75,000-horsepower generator was undergoing tests preliminary to being put into service.

The members were conducted by men of the Hydro staff on tours of the power house proper, the head works, and the tailrace sections of the development.

Several new and interesting engineering works were viewed along the itinerary, including bridges and wiers, which latter are of a design recently developed and tested at the University of Toronto.

After the inspection, the members were guests at a dinner served in the construction camp dining hall. This was followed by illustrated lectures by J. R. Montague and G. F. Simson, of the engineering staff of the Ontario Hydro-Electric Power Commission. Mr. Montague described the civil engineering and hydraulic problems that were encountered and solved during the course of the project, and Mr. Simson explained the electrical features of the development.

More than 160 engineers from the Niagara Peninsula, Niagara Falls, N.Y., and Buffalo were in attendance. Merle F. Ker, chairman of the branch, presided at the meeting.

OTTAWA BRANCH

C. G. Biesenthal, M.E.I.C. - - - *Secretary-Treasurer*
R. C. Purser, M.E.I.C. - - - - - *Branch News Editor*

At the opening noon luncheon of the fall season, held at the Chateau Laurier, September 25, the guest speaker was His Worship Mayor R. Brunet, O.B.E., of Hull, Que. Mr. Brunet, a successful building contractor, related amusing incidents experienced during 40 years' association with engineering work under the general topic **"A Contractor Looks On Engineers".** The humor of his remarks and the manner of their presentation were thoroughly enjoyed by his audience.

In a more serious vein, at the end of his speech, he had these remarks to make about housing. "The biggest problem we face today is housing. They keep on saying that housing will take care of itself. Well, it won't take care of itself. If we don't provide homes for these people soon, the homeless Canadians will be throwing stones at us. Our people deserve better than what they are getting.

"Housing is a very urgent problem. I am told the Alaska Highway was built in 18 months. I know of an airport built in six months. Why can't we have the kind of hustle and energy and co-operation for people's homes that we had for war necessities?"

Col. J. P. Carriere, Hull City Manager and Engineer, and Chairman of the Program Committee, introduced the speaker, and Keith Lachance expressed thanks. Major-General G. R. Turner, Chairman of the Ottawa Branch, presided, and welcomed the guests. Sympathy was expressed to the families of H. M. Barton and F. B. Reid, long standing members of the Branch who died recently.

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At an evening meeting on October 8 at the National Museum, the Ottawa sub-divisions of the Illuminating Engineering Society, the American Institute of Electrical Engineers and The Engineering Institute, heard an address by J. S. Richardson, of the Northern Electric Company, Montreal, who presented a highly interesting picture of present-day life in England.

Mr. Richardson was born and educated in England, served with the British Merchant Marine for 10 years and has travelled to many parts of the world. Absent from England for 18 years he returned to visit his parents several months ago. His talk dealt with present-day conditions there in contrast with those in Canada. Food rations, for instance, while sufficient to maintain health, fall far short of satisfying the average appetite. He spoke about children of the age of nine years who can remember nothing else but food scarcities.

Chairmen of the meeting were W. J. Montabone of the I.E.S., G. R. Davis of the A.I.E.E., and Major-General G. R. Turner, Chairman of the Ottawa Branch of the E.I.C.

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At a noon luncheon on October 9, McNeely DuBose, vice president of the Aluminum Company of Canada, outlined to the Ottawa Branch the story of the Shipshaw hydro-electric power project and of the great aluminum refineries employing this power. The story covered the history of half a century of development on the Saguenay River.

Mr. DuBose told of the concentrated effort required to speed up the expansion of the Shipshaw development in order to meet the heavy demands for aluminum that followed the outbreak of World War II. When the Battle of Britain came, Shipshaw had provided Britain with more than enough aluminum for the planes that immortalized themselves in that battle.

In order to speed up the output, other sources of energy had to be called on as well. Then with regard to Shipshaw itself certain features of the design that might have been used under ordinary circumstances had to give way to others that were capable of rapid construction. Earth dams, for instance, which could only properly be built in non-freezing weather, were replaced by concrete inasmuch as the latter could be constructed right through the winter. In other ways, too, some rather unorthodox designs had to be resorted to, as in the case of waterwheels much larger than ordinary

Mr. DuBose paid high tribute to the builders of Shipshaw, who had been sworn to secrecy as the project rose in the wilderness, and who played an important part in producing the materials that made Allied victory possible.

Major-General G. R. Turner, chairman of the branch, presided.

SAGUENAY BRANCH

J. E. Dyck, M.E.I.C. - - - *Secretary-Treasurer*

Cement Dispersion and Air Entrainment in Concrete was the topic of an address given by Lane Knight, to the Saguenay Branch of the Institute on October 2nd, 1947.

Mr. Knight is vice president of The Master Builders Company Limited of Toronto, Ont., which organization manufactures among other things, a product known as Pozzolith, a material added to concrete to increase its durability.

Using slides, Mr. Knight illustrated a tendency of concrete to remain in lumps which are wetted only on the outer surface. This condition calls for a dispersing agent to distribute the cement in fine particles throughout the mix. The advantage of this dispersion is that more of the cement actually comes into contact with water. This in turn results in the use of less cement for a batch of a particular grade of concrete. The dispersing agent involved is calcium lignosulfonate.

Mr. Knight discussed also the value of pozzolith in reducing bleeding in concrete. "Bleeding" occurs when water rises to the surface of the concrete, evaporates and is lost. Another point discussed was the value of a proper proportion of air entrained in the concrete. The old premise was that dense concrete is the strongest, but tests show that 3 to 5 per cent of air in concrete, if distributed as minute air cells improves the properties of the concrete. This air can be entrained in concrete by additives containing soaps or tallow.

Mr. Knight pointed out that you can't improve poor concrete by the use of additives but when used in conjunction with good concrete they definitely improve its durability.

W. F. Campbell thanked the speaker or behalf of the Branch.

ST. MAURICE VALLEY BRANCH

R. E. Kirkpatrick, Jr.E.I.C. - - - *Secretary-Treasurer*

The Valley Branch held a very successful opening meeting on the afternoon and evening of September 27th at the Ki-8-Eb Golf Club near Three Rivers, Que. The meeting which was attended by over 85 members and their friends took the form of a combined golf tournament and industrial visit: those who did not care to play golf visited the nearby St. Maurice Valley Terminal Station of the Shawinigan Water and Power Company. Both groups met at the golf club for refreshments and supper and heard an address on the subject of **Engineering and Citizenship** by R. J. Clark, the editor of the *St. Maurice Valley Chronicle*. The meeting closed with the distribution of the golf prizes, and an outline of the programme for the coming winter.

TORONTO BRANCH

E. G. Tallman, M.E.I.C. - - - *Secretary-Treasurer*
D. D. Whitson, M.E.I.C. - - - *Branch News Editor*

The first meeting of the 1947-1948 season was held Wednesday, October 1st, at Royal Ontario Museum Auditorium.

Chairman D. Geiger presided and the speaker was Dr. H. B. Speakman, director, Ontario Research Foundation; his subject was **Industrial Research.**

Dr. Speakman opened his remarks with the statement that the Foundation now has fifty assistants working on the problems of industry in this province. Investigations cover such subjects as suitability of the weaves of cloths for garments of different types, colour fastness, fibre characteristics; production of shortening from Canadian grown vegetable oil produced from flax; the salvage of chemical products from waste sulphite liquor from paper mills which, according to Dr. Speakman, can be 40 per cent converted into ether soluble benzine compounds.

Stating that the tempo of world research is rapidly mounting, Dr. Speakman pointed out that while individual industries and universities used to carry out the major share of pure research, now large scale research enterprises are being carried out by the governments of European countries, Great Britain, and the United States. By 1951-1952 the United States Government will have commenced a $250,000,000 research programme of a fundamental type. Dr. Speakman commented on the fact that Canada benefitted largely by American research through the industrial connection of many of its companies, but felt that large scale research by Canadians would tend to develop things Canadian and would be to our greater ultimate advantage than the free acceptance of American products and design. He stressed one point in this connection to support his plea for greater emphasis on research in this country, namely that the veil of secrecy on research findings is being drawn ever more closely all over the world. England no longer gives out any details on atomic developments of any kind, and Russia has a law of secrecy which forbids the giving of any data on research in the Soviet Union. Scientific discovery in the past has thrived most on the free interchange of scientific knowledge between researchers in all countries.

On a recent trip to England to investigate the present status of scientific research in that country, Dr. Speakman found a new progressive outlook to prevail. In areas where extreme conservatism toward change had been the accepted state of affairs, research is now looked on as a necessity, limited in extent only by the funds available. In the textile industry are to be found outstanding examples of pooled industrial research, one centre having 200 scientists working on cotton research alone. Benefits are extended to all manufacturers in the groups, and more than one small manufacturer, who was interviewed stated that he made regular visits to the research centre, and had been able thereby to improve his output and products to a large extent. In Yorkshire, Dr. Speakman saw a carding machine developed by the research centre, whose output was 100 per cent greater than the normal machine used in factories previous to the discovery. He also saw evidence of many worthwhile improvements found and developed in the research centres of the iron and steel manufacturers.

Dr. Speakman also inquired into the status of scientific workers themselves, and found that their income for similar work has improved from 200 pounds per annum in 1915 to 700 pounds today.

The speaker was thanked on behalf of the members by Dean C. R. Young, and the evening ended with refreshments. Ladies had been invited to attend this meeting, and an encouragingly large number attended.

The next meeting is on October 23rd. Room 7, in the Botany Building, when an address will be given by P. B. Dilworth, manager of the Gas Turbine Division of the A. V. Roe Company, on the Development of Jet Propulsion in Canada.

Of interest to all Branch members throughout Ontario is the announcement that the new Ontario Division of the E.I.C. has now come into existence. W. R. Mannock of Fort Erie is the first Chairman, and Ross Graydon is Secretary.

At a recent executive meeting it was decided to canvass the situation again regarding a Toronto building for engineers, with rentable space and private rooms for committee use, library, auditorium, etc. E. A. Cross was appointed to make the preliminary investigation.

VICTORIA BRANCH

S. H. Frame, M.E.I.C. - - - - *Secretary-Treasurer*
Kenneth Reid, M.E.I.C. - - - *Branch News Editor*

On the invitation of E. W. Izard, M.E.I.C., general manager of Yarrows Limited, about thirty-five members of the Victoria Branch and their friends made an inspection of the new Canadian National Steamship now on the ways at Yarrows No. 2 shipyard at Esquimalt on September 6th.

The hull of the ship, to be named *Prince George*, then nearing completion and launched on October 6th, has an overall length of 350 feet; beam 52.0 feet; draft 17.5 feet; gross tonnage about 5700 tons; displacement 5000 tons. She is designed for a speed of 18 knots with twin Vickers Skinner Uniflow engines of 7000 initial horse power fed from 4 Yarrow Naval type water tube oil fired boilers.

The ship will have nine decks. The passenger accommodation will consist of all outside staterooms with disappearing berths to make comfortable day sitting rooms, two

Victoria Branch members inspect the "Prince George" at Yarrows Limited, Esquimalt.

sitting-room and bedrooms suites with bath and w.c., 14 de luxe staterooms with bath and w.c., 26 two berth special staterooms with shower and w.c., 32 three berth special staterooms with shower and w.c., 18 two-berth standard cabins, 18 three-berth standard cabins, and 14 two-berth 2nd class cabins. The total number of passengers accommodated in staterooms is 322 with 20 officers and a crew of 112 or a total of 454. The lifeboat accommodation is for 500 passengers.

The hull construction stem and stern portions are electrically welded with rivetted frames. The centre portion of the ship is constructed with welded butts, riveted seams and riveted frames. The decks are electrically welded on seams and butts, the beams being riveted. The tank top is all welded construction with the interior floors, frames, etc., welded. All bulkheads are welded. The ship has been constructed on an ½" to 1 foot declivity, with the launching ways set at 19/32 inch to the foot.

The *Prince George* when completed will cost in the neighbourhood of $3 millions and is scheduled to be ready for service by March of 1948.

Following the inspection trip the party proceeded to the home of Mr. and Mrs. Izard, where refreshments were served. A sincere vote of thanks for his kindness and hospitality was tendered to Mr. Izard by the Councillor of the Victoria Branch.

Library Notes

Book notes, Additions to the Library of The Engineering Institute, Reviews of New Books and Publications

BOOK REVIEW

CONCRETE MATERIALS AND PRACTICE

L. J. Murdock, London, Edward Arnold; Toronto, Macmillan, 1946. 320 pp., 8¾ x 5¾ in., cloth, $7.50.

Reviewed by Karl E. Whitman, M.E.I.C.*

This work deals with the properties and selection of the ingredients of concrete, the properties of concrete itself, the equipment for and the methods of handling and mixing the ingredients and the placing of the concrete, the building of forms of various types and special uses of concrete.

The book is thoroughly up-to-date and contains much that has not hitherto been published in book form. Frequent reference is made to recent British and American publications. A bibliography listing a very large number of references, many of which are periodicals, is appended.

Along with the more commonly known properties of concrete, plastic flow, movement due to changes in moisture content and autogenous healing are discussed briefly. One chapter is devoted to the production of natural and crushed aggregate, the importance of proper grading and the handling of the aggregates to prevent segregation, another to the manufacture and properties of cement. The design of concrete mixes is described with emphasis on the water-cement ratio. The importance of accurate measurement of the ingredients is stressed in connection with the description of mixing.

The recommendations for mixing and placing are in line with those published in recent years in the United States. Some space is given to a description of mixing and handling equipment. Continuous mixers are described, these apparently being used now to some extent in Great Britain, as well as the so-called pan type, not commonly used here.

Design is discussed only briefly.

This book would be useful to the engineer in charge of concrete construction or to the student as a source of information on matters pertaining to concrete other than design.

**Designing Engineer of Bridges, Department of Highways and Public Works of Nova Scotia, Halifax, N.S.*

ADDITIONS TO THE LIBRARY

TECHNICAL BOOKS, ETC.

Air Conditioning:

Herbert and Harold Herkimer. Brooklyn, Chemical Publishing Company, 1947. 692 pp., illus., cloth.

Aluminium Alloy Castings; theirFounding and Finishing:

E. Carrington. London, Griffin, 1946. 326 pp., illus., cloth.

British Chemical Plant:

British Chemical Plant Manufacturers' Association, London, (1947). 212 pp., illus., cloth.

Chemical Facts and Figures; Useful Information and Statistics Relating to the Chemical and Allied Products Industries, 2nd ed.:

M. F. Crass, Jr. Washington, Manufacturing Chemists' Association, 1946. 401 pp., illus., paper.

Chemical Process Principles: Part Three—Kinetics and Catalysis:

Olaf A. Hougen and Kenneth M. Watson. N.Y., Wiley, (c1947). 303 pp., illus., cloth.

Conference Guide to Basic Management Training; a Program of Directed Conference Suggestions for the Conference Leader:

Arthur S. Hotchkiss. N.Y., National Foremen's Institute, 1947. 196 pp., illus., cloth.

Cours de Mecanique: Tome Premier—Statique:

Henry Favre. Paris, Dunod, 1946. 384 pp., illus., paper.

Cutter-Sanborn Author-Marks; Three-Figure Tables:

C. A. Cutter and Kate E. Sanborn. Springfield, Mass., Huntting, n.d. 18 pp., fabrikoid.

Descriptive Geometry for Architects and Builders:

Leslie A. Lee and R. Fraser Reekie. London, Arnold, (1945). 224 pp., illus., cloth.

Electronic Theory and Chemical Reactions; an Elementary Treatment:

R. W. Stott. London, Longmans, (1943). 112 pp., illus., cloth.

Elementary Nuclear Theory; a Short Course on Selected Topics:

H. A. Bethe. N.Y., Wiley, 1947. 147 pp., illus., cloth.

NOTICE

Bank, Foreign Exchange, and Postage Charges are not included in the prices listed. Members are therefore requested to await receipt of invoice before forwarding remittance in payment of publications ordered through the Institute Library.

Flexible Couplings; their Value and Many Advantages:

Poole Foundry and Machine Company, Baltimore, n.d. 124 pp., illus., leather.

Fundamentals of Electricity and Magnetism; 3rd ed.:

Leonard B. Loeb. N.Y., Wiley, 1947. 669 pp., illus., cloth.

Hot-Water Heating and Radiant Heating and Radiant Cooling:

F. E. Giesecke. Austin, Texas, Technical Book Company, 1946. illus., cloth.

ICAO Regional Manual—North Atlantic (Doc 4500); Special Addendum:

International Civil Aviation Organization, Montreal, 1947.

Manual of Aluminum Casting Alloys:

Aluminum Research Institute, Chicago, (c1947). 78 pp., illus., leather.

One Two Three . . . Infinity; Facts and Speculations of Science:

George Gamow. N.Y., Viking, 1947. 340 pp., illus., cloth.

Power System Stability: Volume II—Transient Stability:

Selden B. Crary. N.Y., Wiley, (c1947).

Principles of Industrial Management; 4th ed.:

E. A. Allcut. Toronto, Pitman, (c1947). 308 pp., illus., cloth.

Reinforced Concrete Design; 2nd ed.:

G. P. Manning. London, Longmans, (1945). 498 pp., illus., cloth.

Resistance Welding Manual, rev. ed.:

Resistance Welder Manufacturers' Association, Philadelphia, (1946). 544 pp., illus., cloth.

Survey of the Principles and Practice of Wave Guides:

L. G. H. Huxley. Cambridge, University Press, 1947. 328 pp. illus., cloth.

Traffic Survey of Alexandria Metropolitan Area:

Louisiana Department of Highways and Local Government Units in Cooperation with U.S. Public Roads Administration, 1947. 107 pp., illus., paper.

Textbook of the Materials of Engineering; 7th ed.:

Herbert F. Moore. N.Y., McGraw-Hill, 1947. 500 pp., illus., cloth.

PROCEEDINGS, TRANSACTIONS, ANNUALS, ETC.

Canada. Department of Labour. Information Branch:

Thirteenth Report on Organization in Industry, Commerce and the Professions in Canada, 1947.

Institution of Mining and Metallurgy:

Transactions, Volume 54, 1945.

Kenya and Uganda Railways and Harbours:

Report of the General Manager on the Administration of the Railways and Harbours, for the Year ended 31st December, 1946.

Ontario. Hydro-Electric Power Commission:

Thirty-ninth Annual Report, 1947.

Ontario Mining Association:

Report of Directors for 1946.

Society of Naval Architects and Marine Engineers:

Transactions, Volume 54, 1946.

TECHNICAL BULLETINS, ETC.

Battelle Memorial Institute. Bituminous Coal Research:

Technical Report No. VIII—Overfire Jets and Controls for Locomotive Smoke Abatement, Eugene D. Benton.

Canada. Bureau of Mines:

Publication No. 816—Physical Properties of Canadian Building Brick, J. G. Phillips.

Canada. Parliament:

8 George VI, Chapter 46—National Housing Act, 1944.

Edison Electric Institute:

Publication No. P-4—Metallurgy and Piping, 1947.—No. P-6—Heat Pump; What it is—its History—the Electric Company's Interest in its Development.

Institution of Mechanical Engineers:

Publications—Dynamic Yield Strength of Steel at an Intermediate Rate of Loading, A. F. C. Brown and R. Edmonds.—Manufacture of Turbine Blades for the Whittle Engine, T. A. Kestell.—Tensile Yield Strength of Certain Steels under Suddenly Applied Loads, F. V. Warnock and J. B. Brennan.

U.S. Geological Survey. Bulletin:

946—Geologic Investigations in the American Republics, 1944-1945.—955-A—Drill-Hole Correlation as an Aid in Exploration of Magnetite Deposits of the Jersey Highlands, New York and New Jersey.—957-A—Geophysical Abstracts 128, January-March 1947.—957-B—Geophysical Abstracts 129, April-June 1947.

. . . Technical Paper:

698—Bibliography of Bureau of Mines Investigations of Coal and its Products, 1940 to 1945, A. C. Fieldner, P. L. Fisher, and Marjorie B. Pollock.

. . . Water Supply Paper:

1018—Water Levels and Artesian Pressure in Observation Wells in the United States in 1944: Part 3—North-Central States.—1019—Water Levels and Artesian Pressure in Observation Wells in the United States in 1944: Part 4—South-Central States.—1020—Water Levels and Artesian Pressure in Observation Wells in the United States in 1944: Part 5—Northwestern States.

Yale Bureau of Highway Traffic. Technical Report:

No. 1—Traffic Performance at Urban Street Intersections, Bruce D. Greenshields, Donald Schapiro, and Elroy L. Ericksen.—No. 3—Economic Study of Interior Block Parking Facilities, Charles S. LeCraw.

STANDARDS, SPECIFICATIONS, ETC.

British Standards Institution. Code of Practice:

CP (B) 673—Excavation for Drainage Work.—CP (B) 674—Manholes.—CP (B) 675—Cesspools.—CP (B)6 76—Site Investigations.

British Standards Institution. Standards:

61: Part 1: 1947—Copper Tubes (Heavy Gauge) for General Purposes.—679: 1947—Protective Filters for Welding and Other Industrial Operations.—1313: 1947—Fraction-Defective Charts for Quality Control.—1374: 1947—Log-Sheets for Steam Boiler Plants.—1394: 1947—Power Driven Circulators for Heating Plants.

Canadian Standards Association. Standards:

C22.4-No. 108-1947—Construction and Application of Suppressors for Radio Interference.—W47-1947—Welding Qualification Code for the Application to Fabricating and Contracting Firms; their Welding Personnel and Equipment.

Institute of Petroleum:

Electrical Code, 1946.

PAMPHLETS, ETC.

Atlas of Defects in Casting:

Institute of British Foundrymen, Manchester, 1946.

Bibliography of Statistical Quality Control:

Grant I. Butterbaugh. Seattle, Washington, University of Washington Press, 1946.

Canada's Defence; Information on Canada's Defence Achievements and Organization:

Department of National Defence, Ottawa, (1947).

Canadian Marine Radar:

National Research Council of Canada, Ottawa, 1947.

Engineering Profession in Transition:

Andrew Fraser. N.Y., Engineers' Joint Council, (c1947).

Euler's Classic Paper "On the Strength of Columns":

J. A. Van den Broek. (1947).

Heat Pump Bibliography:

Southern Research Institute, Birmingham, Alabama, 1947.

Management Engineering in Industrial Research Laboratories:

Henry A. Martin. N.Y., Clark, 1947.

Pattern for Parking:

W. E. Hobbs. (1947).

Theory of Limit Design applied to Magnesium Alloy and Aluminum Alloy Structures:

Filadelfo Panlilio. London, Royal Aeronautical Society, 1947.

Welding and Cutting; Eighteen Months' Progress as Reflected in the Technical Literature:

R. D. Williams. (1947).

BOOK NOTES

Prepared by the Library of The Engineering Institute of Canada.

The Institute does not assume responsibility for any statements made; these are taken from the preface or the text of the book.

BEARING METALS AND BEARINGS: A LIST OF ARTICLES PUBLISHED BETWEEN 1942 and 1946; (N.R.C. No. 1324):

R. Ruedy. Ottawa, National Research Council of Canada, 1946. 54 pp., 11 x 8½ in., paper, 25c.

This bibliography is supplementary to the list of articles published between 1936 and 1941. The articles are arranged alphabetically under author, except for those published without the author's name, which appear in a group by themselves. A short list of recent specifications has been appended. The bearings included are those of alloys containing tin, antimony, copper, cadmium and lead; light alloys, porous metals, and silver; and bearing strip such as copper-lead steel-backed or lead-tin steel-backed tri-metal bearings, or plated and annealed triplex bearings consisting of steel shells electroplated with silver lead and iridium or tin.

CANADIAN TRADE INDEX; ANNUAL ISSUE OF 1947:

Canadian Manufacturers' Association, Toronto, c1947. 1118 pp., illus., 10¼ x 7 in., cloth, $6.00.

The index includes an alphabetical list of 10.000 manufacturing firms with addresses, branches, brands and trade names, cable addresses and foreign representatives, and a classified list of thousands of industrial products with the names of firms manufacturing them. It also includes a Special Export Section giving basic information in regard to government services, foreign trade controls, methods, financing, price quotations, and British Empire tariff preferences. All copies include a French Index of Products.

CUBICLES AND CONTROL DESKS:

F. T. Bennell. Manchester, Emmott, 1946. 50 pp., illus., 7¼ x 5 in., paper, 2/6—.

The items of equipment dealt with in this pamphlet are representative of the bulk of steel housings for electrical equipment, and the principles involved in their construction have a general application. Concern is primarily with the reasons underlying the use of various designs and manufacturing methods rather than with the designs and methods themselves, in order to be more generally applicable and flexible and suit various requirements.

ELECTRONICS; WHAT EVERYONE SHOULD KNOW:

Calvin and Charlotte Mooers. Indianapolis, Bobbs-Merrill; Toronto, McClelland & Stewart, c1947. 231 pp., illus., 8¼ x 5¾ in., cloth, $3.25 in Canada.

This book tells clearly how and where electronics works behind the scenes of everyday life. To explain how an electronic tube operates, the authors use as illustrations devices such as radios, computing machines, radar, electric eyes, and other well-known technical objects. Anyone with an intelligent curiosity about electronics has enough background to enjoy and understand this book.

EXPLAINING THE ATOM:

Selig Hecht. New York, Viking, Toronto, Macmillan, 1947. 205 pp., illus., 8½ x 5½ in., cloth, $3.25 in Canada.

This is a book for the layman that will easily convey the intellectual drama of the developments in physics during the last fifty years. It follows the steps that were taken historically in going from the earliest questions about the nature of common substances to the large-scale liberation of atomic energy. The author's purpose is to supply a background against which people can think and act intelligently on the problems of atomic energy.

INFRA-RED HEATING:

A. E. Williams. Manchester, Emmott, 1947. 42 pp., illus., 7¼ x 5 in., paper, 2/6—.

This pamphlet is a review of the sphere of infra-red rays and their applications to industry. In the opinion of the author there is room for both gas and electricity in the field. This method of drying is being gradually applied to materials other than paint, and it is shown in the latter part of the monograph that convection currents—as used in the more conventional form of dryer—must play a part with infra-red in the drying of some materials.

PLASTICS IN INDUSTRY:

A. E. Williams. Manchester, Emmott, 1947. 41 pp., illus., 7¼ x 5 in., paper, 2/6—.

There are much stronger plastic materials than those produced from moulding powders, and these can be of real value to the engineer. This pamphlet describes these engineer's materials, how they are machined, and what the engineer can hope to produce from them.

RELATIVITY; THE SPECIAL AND GENERAL THEORY:

Albert Einstein; translated by Robert W. Lawson, New York, Peter Smith, c1947. 168 pp., illus., 8¼ x 5½ in., cloth, $2.50.

Einstein's RELATIVITY has been unavailable to the general public for almost twenty years, partially because of the lack of reviewers' comment and partially because its importance at the time of issue was unappreciated. Now, however, that the atomic nucleus has erupted into our world, the time has come to understand the basic principles of the science that can be used for so much destruction and equally for so much good. The book is intended, as far as possible, to give an exact insight into the theory of Relativity to those readers who, from a general scientific and philosophical point of view, are interested in the theory, but who are not conversant with the mathematical apparatus of theoretical physics. The work presumes a standard of education corresponding to that of a university matriculation examination, and, despite the shortness of the book, a fair amount of patience and force of will on the part of the reader. The edition is complete and unabridged.

SALES ADMINISTRATION; PRINCIPLES AND PROBLEMS, rev. ed.:

Bertrand R. Canfield. New York, Prentice-Hall, 1947. 606 pp., illus., 9 x 6 in., cloth, $6.35.

The purpose of this book is to give students of business, sales executives, and others a simple and concise description of the principles involved in the solution of the paramount problems of sales administration. Following a description of the principles of each phase of sales management are several problems, illustrating the application of the fundamentals recorded in the text. These problems are based on the actual experiences of business organizations in various lines of industry. Each problem is followed by a list of questions, and each chapter has a list of reading references. A general bibliography is appended.

TALKING WIRE; THE STORY OF ALEXANDER GRAHAM BELL:

O. J. Stevenson. New York, Messner, Toronto, Macmillan, c1947. 207 pp., illus., 8½ x 6 in., cloth, $2.75 in Canada.

This is the story of the inventor of the telephone, written in very readable form, and intended for the layman. It concentrates on story rather than science, and is attractively illustrated by Lawrence Dresser.

TIME, KNOWLEDGE, AND THE NEBULAE; an Introduction to the Meanings of Time in Physics, Astronomy, and Philosophy, and the Relativities of Einstein and of Milne:

Martin Johnson. New York, Dover, c1947. 189 pp., illus., 8¾ x 5½ in., cloth, $2.75.

This book is a first attempt to dissect out some of the meanings of physical time. The resulting view of the nature and structure of scientific knowledge may serve to explain the obstacles which prevent the philosopher from formulating his more ultimate question as to the reality of time in human destiny, a question inaccessible to physics itself. The book is therefore written not merely for the research specialist in mathematical physics, astronomy, or logic, but for the working scientist or student, and for the general public demanding to know where scientific attitudes might lead. So while discussing the idea of Time in Determinacy, in laws of Cause and Effect, in Relativity, and particularly in the so-called expanding universe of nebulae, together with recent trends in philosophy affected by physics, the book presupposes no technical acquaintance with these subjects.

The following book notes appear here through the courtesy of the Engineering Societies Library of New York. The books may be consulted at the Institute Library.

ALUMINUM ALLOY CASTINGS, THEIR FOUNDING AND FINISHING:

E. Carrington. Charles Griffin and Company, London; Ryerson Press, Toronto, 1946. 326 pp., illus., diagrs., tables, 9¼ x 6 in., cloth, 25s, $7.50 in Canada.

This comprehensive work covers all processes of aluminum founding from the pattern to the finished, inspected casting. In addition to the basic melting and casting activities, there are also chapters on sand control, die preparation, dressing and repairing, after-treatment of the cast surfaces, and machining. The general organization and operation of an aluminum foundry are briefly considered, and extensive lists of references accompany the several chapters.

ATLAS OF DEFECTS IN CASTINGS. Series 1:

Institute of British Foundrymen, St. John Street Chambers, Deansgate, Manchester 3, England, 1946. 34 pp., illus., 10 x 6½ in., stiff paper, 10s. 6d.

Some forty casting defects are covered in this first series of descriptive sheets which are intended to assist ferrous and non-ferrous foundrymen in the recognition and classification of such defects. Each sheet contains a photographic example of the defect with explanatory text, a statement of the cause or causes, and suggested remedies.

BIBLIOGRAPHY OF STATISTICAL QUALITY CONTROL:

G. I. Butterbaugh, published for the Bureau of Business Research of the College of Economics and Business by the University of Washington Press, Seattle, Wash., 1946. 114 pp., 9 x 6 in., paper, $1.50.

The references contained have been carefully chosen to make certain that the statistical aspect is emphasized, and annotations are provided to assist the person consulting the list in selecting the most useful items. Part I lists magazine articles, arranged alphabetically by name of magazine and for each magazine consecutively by date of appearance. Part II lists manuals, monographs and pamphlets alphabetically by the companies or organizations responsible, and Part III lists books by author. A combined author index for the more than 700 included items is provided.

CALCULATING MACHINES

D. R. Hartree. University Press, Cambridge, England; Macmilan Company, New York, Toronto, 1947. 40 pp., illus., tables, 7 x 5 in., paper, $.55 in Canada.

This small book briefly describes the operation and functions of the components of the ENIAC (Electronic Numerical Integrator and Calculator), the only completed and operating machine using electronic circuits as the actual computing elements. The tremendous increase in speed of calculation is discussed, examples of application are given, and prospective developments are indicated with their impact on mathematical physics.

CHEMICAL FACTS AND FIGURES. 2 ed., 1946:

Compiled by M. F. Crass, Jr., published by Manufacturing Chemists' Association of the United States, 608 Woodward Bldg., Washington 5, D.C., 401 pp., diagrs., charts, maps, tables, 10½ x 8 in., paper, $2.00.

The first edition of this reference volume was issued in 1940 to fill the need for a single publication which would include significant chemical statistics from official sources. In general, the second edition takes up where the first edition left off without duplication of data. Published statistics cover general figures on production, research, and value of output in the chemical industry; specific figures on production, value of product, imports, exports, consumption, etc. for a great variety of mined, processed and manufactured commodities in the chemical and mineral fields. Additional sections cover such topics as safety, prices, tax data, and wage and employment statistics.

COLLEGE PHYSICS, MECHANICS, HEAT AND SOUND:

F. W. Sears and M. W. Zemansky. Addison-Wesley Press, Inc., Cambridge 42, Mass., 1947. 383 pp., illus., diagrs., charts, tables, 9¼ x 6 in., cloth, $6.00.

Constituting the first part of a college physics text, this volume covers the subjects of mechanics, heat and sound. It is intended for students whose mathematical background is restricted to algebra and trigonometry. The emphasis of the book is on physical principles. Historical background and practical applications are of secondary importance. The treatment of the subject matter is held within a scope which may be covered in one semester.

INSTITUTE OF PETROLEUM ELECTRICAL CODE:

Institute of Petroleum, Manson House, 26 Portland Place, London, W.1., 1946. 77 pp., tables, 8½ x 5½ in., paper, 5s.

The definitions, rules, and code schedules presented in this publication are issued provisionally with a view to experience being gained and in anticipation of reports in regard to the practical application of the code in industry. Special topics covered are the problems of dangerous atmospheres and the avoidance of fire arising from lighting, static, and other electrical causes. It also covers flexible cables for use in dangerous areas.

PHOTOGRAMMETRIC CONTROL EXTENSION, Supplementary to "Applied Photogrammetry".

R. O. Anderson. Obtainable from Edwards Brothers, Ann Arbor, Mich., 1947. 52 pp., diagrs., tables, 9 x 6 in., paper, $1.00.

This publication, supplementary to the author's "Applied Photogrammetry", explains the control extension process on aerial photography (for both horizontal and vertical positions) without ground measurements except at flight-ends. A complete fictitious example is constructed and the detailed solution is carried out and checked as a numerical verification of the theory.

PRACTICAL THEORY OF MECHANISMS:

P. Grodzinski. Emmott & Co., Ltd., 31 King St. West, Manchester, England, 1947. 166 pp., diagrs., charts, tables, 6¾ x 4 in., cloth, 7s 6d.

Presenting an introduction to the basic principles of the theory of mechanisms, this book endeavors to make the reader realize the value of these ideas in dealing with all engineering problems. As an aid to understanding, the author isolates the mechanism from its machine and neglects forces, speeds, accelerations, etc. The screw mechanism, the four bar link and derived mechanisms, cams, gear trains, belt and fluid drives, and ratchets are the basic mechanisms discussed. The book is a revised and enlarged translation of the author's "Angewandte Getriebelehre".

RESISTANCE WELDING MANUAL (Revised Edition):

Published by Resistance Welder Manufacturers' Association, 505 Arch St., Philadelphia, Pa., 1946. 544 pp., illus., diagrs., charts, tables, 9¼ x 5¾ in., cloth, $3.00.

The introductory section of this Manual covers technical and economic fundamentals. Section II describes in detail the various resistance welding processes. The resistance welding characteristics of various important metal groups are considered seperately in Section III, with information on how these characteristics affect welding procedures. Mechanical and electrical characteristics of welding machines are also covered in this section. Sections new in this revised edition deal with inspection, testing, and quality control, and with maintenance of equipment. Useful data tables and a glossary are appended.

SIMPLIFIED ENGINEERING FOR ARCHITECTS AND BUILDERS:

H. Parker. 2 ed. John Wiley & Sons, New York; Chapman & Hall, London, 1947. 245 pp., diagrs., charts, tables, 8 x 5 in., cloth, $3.00.

The purpose of this volume is to supply architectural draftsmen and builders who have no training in engineering, with sufficient data to enable them to solve simple structural problems. A knowledge of arithmetic and high school algebra is required. Basic principles of forces in equilibrium are first discussed and then applied to timber, steel and reinforced concrete construction. In this second edition, changes were necessary because of revisions in building code requirements, and new problems have been added.

SOCIETY FOR EXPERIMENTAL STRESS ANALYSIS. Proceedings, Vol. 4, No. 2:

Edited by C. Lipson and W. M Murray; published and distributed by Addison-Wesley Press, Inc., Kendall Square, Cambridge 42, Mass., 1947. 121 pp., illus., diagrs., charts, tables, 11¼ x 8½ in., cloth, $6.00.

A history of the Society, lists of members, and twelve papers are presented in this volume. The papers are as follows: Fatigue Tests of Major Aircraft Structural Components; Precision Determination of Stress-Strain Curves in the Plastic Range; A Method of Detecting Incipient Fatigue Failure; A Machine for Fatigue Testing Full-Size Parts; Some Repeated Load Investigations on Aircraft Components; Stress Analysis Utilization in Dynamic Testing; Device for Maintaining Continuous Electrical Connections with Reciprocating Engine Parts; Evaluation of Various Methods of Rotor-Blade Analysis by Means of a Structural Model; Reluctance Gages for Telemetering Strain Data: The Linear Variable Differential Transformer; Design and Application of Accelerometers; Aircraft Instruments for Radio-Telemetering and Television-Telemetering.

ULTRAHIGH FREQUENCY TRANSMISSION AND RADIATION:

N. Marchand. John Wiley & Sons, New York; Chapman & Hall, London, 1947. 322 pp., illus., diagrs., charts, tables, 9 x 6 in., cloth, $4.50.

Presenting the basic principles of the radiation and transmission of electromagnetic waves, this volume is intended for both the practising engineer and the electrical engineering student. A mathematical approach is used in the derivations, with a detailed analysis of the results to enable the reader to understand the phenomena taking place. These derivations lead to results that can be practically applied. Transmission lines, antennas, and wave guides are discussed, not only in theory, but also as items which must be successfully designed, constructed and used.

VARNISHED CLOTHS FOR ELECTRICAL INSULATION:

By H. W. Chatfield and J. H. Wredden. J. & A. Churchill Ltd., London, 1946. 255 pp., illus., diagrs., charts, tables, 8¼ x 5¼ in., cloth, 21s.

The authors have brought together in this book a considerable amount of ordinarily scattered information. Four basic topics are dealt with: the textiles which form the supporting fabric; the impregnating varnishes; the manufacture of the treated fabrics;

the properties and uses of the varnished cloths as insulating mediums. Additional information is given on methods of storage, analysis, and testing of the raw materials and the finished product.

Although not available in the Institute Library, inquiries concerning the following new books will be welcomed there or may be sent direct to the publishers.

A.S.T.M. STANDARDS ON CEMENT (with Related Information):

Prepared by A.S.T.M. Committee on Cement; Specifications, Chemical Analysis, Physical Tests; October, 1946. American Society for Testing Materials, 1916 Race St., Philadelphia 3, Pa. 185 pp., illus., diagrs., tables, 9 x 6 in., paper, $2.00.

Included in this compilation are specifications for portland, blast-furnace, natural, masonry and air-entraining cements, together with some fifteen standard methods of chemical analysis and physical testing. Supplementary information on analytical balances and weights and cement testing in general is appended. There are also a list of selected references and an article on the principle of the methoxyl method for determining vinsol resin in portland cement.

AUDEL'S MACHINISTS AND TOOL MAKERS HANDY BOOK:

By F. D. Graham. Theo. Audel & Co., Publishers, 49 W. 23rd St., New York, 1946. 1126 pp., Sections B-E paged separately, illus., diagrs., charts, tables, 6½ x 4¾ in., fabrikoid, $4.00.

Section A of this practical manual first describes shop tools, methods of measuring, materials, and heat treating processes. The essentials of the various machines are then taken up in succession, followed in each case by detailed instructions on all machining operations. The extensive use of line drawings and photographs effectively illustrates the text material. Drawing and blue print reading are covered in Section B, shop mathematics in Section C, elementary physics and slide rule calculations in Sections D and E. Technical data tables are included where they will be most useful.

ENGINEERING ORGANIZATION AND METHODS:

By J. E. Thompson. McGraw-Hill Book Co., New York and London, 1947. 337 pp., illus., diagrs., charts, tables, 9¼ x 6 in., cloth, $4.00.

This book furnishes industrial executives and supervisors with tested techniques for speeding up production and reducing costs in product-design engineering departments. Offering a specific fundamental plan for organizing, operating and controlling these departments, it describes practical methods which have been used successfully in both large and small engineering sections of a wide variety of technical concerns. The book supplies the complete data necessary for the orderly preparation, processing and recording of engineering information, and also includes a useful, general discussion of the functions of supporting departments.

FLUORESCENT LIGHTING:

By A. D. S. Atkinson. Chemical Publishing Co., Brooklyn, New York, 1946. 144 pp., illus., diagrs., charts, tables, 8¾ x 5½ in., cloth, $3.50.

Full details of the construction and operation of all types of fluorescent lighting are given, and the application of fluorescent lamps in factories, public buildings, domestic interiors, etc. is discussed and illustrated. The book is intended as a reference work for technical workers in the field as well as a text for electrical engineering students. The terminology differs from American usage in some respects, since the book is a facsimile of the second edition of a British book.

FOUNDRY SAND TESTING HANDBOOK, Standards and tentative standards Adopted by the American Foundrymen's Association. 5th ed., 1944:

American Foundrymen's Association, 222 W. Adams St., Chicago, Ill. 176 pp., illus., diagrs., charts, tables, 9¼ x 6 in., cloth, $3.50.

This publication provides a standard reference book on methods of testing and grading foundry sands and clays. It includes not only the standards accepted by the American Foundrymen's Association and the tentative standards, but also data on tests now in use but not yet considered as standard procedures. There is a glossary of terms, and over 450 references to American and foreign literature are listed in a bibliography on sand testing and control.

FREEHAND SKETCHING FOR ENGINEERS:

W. W. Turner. Ronald Press Company, New York, 1946. 33 pp. of text; Plates A-J; 45 sheets of drawing problems; diagrs., tables, 11 x 8½ in., paper, $2.50.

This publication consists of two general sections. The text section contains general suggestions for the student, freehand sketching procedure, and specific working instructions for individual sheets. The large number of plates are divided into a lettered series from A to J for study purposes, a series of drawing problems numbered 1 to 45, and nine practise sheets. The pages and plates are unbound, but are fastened together and contained in a heavy envelope.

GENERATORS AND MOTORS AND THEIR APPLICATION:

By D. J. Duffin. McGraw-Hill Book Co., New York and London, 1947. 210 pp., illus., diagrs., charts, tables, 10 x 7¼ in., cloth, $4.00.

This manual, for on-the-job use by armature winders and electric-motor repairmen, presents fundamental motor and generator theory. It provides important working data on a wide variety of types and makes of alternating-current and direct-current equipment. Clear-cut external, sectional, and disassembled views of machinery add to its practical value. This first of a projected series of three manuals also contains information on selection, applications, maintenance and trouble shooting.

INVENTIONS AND THEIR MANAGEMENT:

By A. K. Berle and L. S. de Camp. 2 ed. International Textbook Co., Scranton, Pa., 1947. 742 pp., illus., diagrs., charts, tables, 8½ x 5 in., cloth, $6.00 ($5.00, College ed.).

This comprehensive work presents the principles and practices governing the technical, legal and business procedures of invention, from the history and theory of the protection of ideas to the methods of exploitation. Numerous illustrative cases from actual experience are given. Foreign patents, trade-marks and copyrights are discussed, and a glossary and a detailed index are included. The new edition contains a discussion of the Lanham Act and a new chapter on trends in industrial research and invention.

MACHINE DESIGN:

L. J. Bradford and P. B. Eaton. 5th ed. John Wiley & Sons, New York; Chapman & Hall, London, 1947. 283 pp., illus., diagrs., charts, tables, 8½ x 5½ in., cloth, $3.25.

Beginning with fundamental definitions and considerations, this textbook proceeds to cover various basic machine elements, such as bearings, shafts, gearing, frames, etc. In the interests of effective grounding in this subject, special machines, shortcut formulas, and graphical methods have been given little consideration in order to emphasize the generalized aspects with their fundamental equations. Additions to the new edition relate principally to the fatigue of metals, friction and lubrication, and design of aluminum parts.

MECHANICAL VIBRATIONS:

By J. P. Den Hartog. 3 ed. McGraw-Hill Book Co., New York and London, 1947. 478 pp., diagrs., charts, tables, 9¼ x 6 in., cloth, $6.00.

The present edition of this well-known book deals with vibration phenomena in a thoroughly technical manner, while emphasizing the many applications of principles and calculations to the practical vibration problems encountered by the engineer. All material has been brought up to date, and a new chapter on helicopter ground vibrations has been added. As in previous editions, complete explanations and proofs are given, without employing mathematics higher than simple differentiations and integrations. There is a bibliography.

SCIENCE SINCE 1500:

H. T. Pledge. Philosophical Library, New York, 1947. 357 pp., illus., diagrs., charts, maps, tables, 9¾ x 6 in., cloth, $5.00.

Following an introductory discussion of scientific development prior to 1500, the succeeding centuries are considered successively, giving a cross-section of the parallel evolution of the several sciences. Together with the progressive discoveries and inventions and the epoch-making theories, some account is given of the men who contributed. This condensed recapitulation of the labors and achievements of science since the Renaissance is illustrated by charts, graphs and maps demonstrating the continuity of the process. There are detailed subject and name indexes and a suggestive bibliographical note.

STRUCTURAL ANALYSIS, the Solution of Statically Indeterminate Structures:

By W. F. Cassie, with a foreword by H. J. Collins. Longmans, Green and Co., New York and London, 1947. 260 pp., diagrs., charts, tables, 8¾ x 5½ in., cloth, $4.25.

Covering statically indeterminate structures, this book is designed to demonstrate the application of fundamental concepts to numerical problems Each chapter shows, by a series of graded examples, how one particular method of analysis is employed. Assuming a familiarity with the theory of simple beams and

(*Continued on page 571*)

PRELIMINARY NOTICE

of Applications for Admission and for Transfer

November 20th, 1947

The By-laws provide that the Council of the Institute shall approve, classify and elect candidates to membership and transfer from one grade of membership to a higher.

It is also provided that there shall be issued to all corporate members a list of the new applicants for admission and for transfer, containing a concise statement of the record of each applicant and the names of his references.

In order that the Council may determine justly the eligibility of each candidate, every member is asked to read carefully the list submitted herewith and to report promptly to the Secretary any facts which may affect the classification and selection of any of the candidates. In cases where the professional career of an applicant is known to any member, such member is specially invited to make a definite recommendation as to the proper classification of the candidate.*

If to your knowledge facts exist which are derogatory to the personal reputation of any applicant, they should be promptly communicated.

Communications relating to applicants are considered by the Council as strictly confidential.

The Council will consider the applications herein described at the December meeting.

L. Austin Wright, General Secretary

*The professional requirements are as follows:—

A **Member** shall have been engaged in some branch of engineering for at least six years, which period may include apprenticeship or pupilage in a qualified engineer's office or a term of instruction in a school of engineering recognized by the council. In every case a candidate for election shall have held a position of professionl responsibility for at least two years. The occupancy of a chair as professor, assistant professor, associate professor or lecturer in a faculty of applied science or engineering, shall be considered as professional responsibility.

Every candidate who has not graduated from a school of engineering recognized by the council shall be required to pass an examination as prescribed by council, on the theory and practice of engineering, with special reference to the branch of engineering in which he has been engaged.

A **Junior** shall have been engaged in some branch of engineering for at least four years. This period may be reduced to one year, if the candidate for election has graduated from a school of engineering recognized by the council, in which case he shall not remain in the class of Junior beyond the end of the eighth year after graduation.

Every candidate who has not passed the examinations of the third year in a school of engineering recognized by council shall be required to pass an examination in engineering science as prescribed by council. He shall not remain in the class of Junior beyond age thirty.

A Junior may be transferred to Member without payment of transfer fee providing he makes application before the end of the seventh year after graduation or, if a non-graduate, before attaining age twenty-nine, and his application is approved by council.

Council may extend the above limits if in its opinion special circumstances warrant such extension.

A **Student** shall be at least seventeen years of age, and shall present a certificate of having passed an examination equivalent to the final examination of a high school, or the matriculation of an arts or science course in a school of engineering recognized by the council or shall be required to write examinations as prescribed by the council.

He shall be:

a. pursuing a course of instruction in a school of engineering recognized by the council, in which case he shall be transferred to Junior automatically without payment of transfer fee in the second January after graduation, or

b. receiving a practical training in the profession in which case he shall be transferred to Junior without payment of transfer fee providing he makes application before attaining age twenty-five and his application is approved by council.

He shall not remain in the class of Student after he has attained the age of twenty-five, unless in the opinion of council special circumstances warrant the extension of this age limit.

An **Affiliate** shall be one who is not an engineer by profession but whose pursuits, scientific attainments or practial experience qualify him to co-operate with engineers in the advancement of professional knowledge.

The fact that candidates give the names of certain members as reference does not necessarily mean that their applications are endorsed by such members.

FOR ADMISSION

BONTER—NORMAN ARTHUR, of London, England. Born at Toronto, Aug. 6, 1913. Educ.: Danforth Tech. School, 1927-29; with R.C.E., as follows: 1935-39, dftsman, computer, photogrammetrist, Air Survey Officer. 1943-46, i/c Air Survey Section, 10, CIC, APIS, 1st Cdn. Army. Supervisor, Surveys Branch DHO; 1946 to date, tech. supt. and manager, Aerographic Surveys Ltd., Weybridge, Surrey, England.

References: A. I. Bereskin, L. G. Trorey, O. F. Bush, J. A. C. Bowen, H. L. Meuser.

CARSCALLEN—CHARLES NEWTON, Major, R.C.E.M.E., of Ottawa, Ont. Born at Chengtu, West China, Aug. 10, 1906. Educ.: B.A., Toronto, 1928, EME Course, Barriefield, Ont., 1941-42; Graduate, Cooperative Engrg., General Motors Institute, Flint, Mich.; 1930-41, asst. chassis engr., consisted chiefly of releasing designs of vehicle components suitable for purchase of mfg. and assembly at Oshawa plant, engrg. dept., General Motors of Canada; 1942-44, Tech. Staff Officer, Tank Design Section, Dept. of Munitions & Supply; initiating design modifications required on tanks produced at Montreal Loco. Works, spent 8 mos. at U.S. Army Ordnance Tank-Automotive Centre, Detroit as Tech. Liason Officer for Dept. of M. & S.; 1944-45, Tech. Staff Officer for British, reported on wheeled vehicle develop'ts. to Canada through C.M.H.Q., 6 mos. on tech. intelligence missions to Germany for the M. of S., Ministry of Supply, London, Eng.; at present, Tech. Staff Officer, (TSO II) Directorate of Vehicle Development, Q.M.G. Branch, Army H.Q., Ottawa.

References: R. E. Jamieson, A. M. Bain, F. F. Fulton, P. C. King, R. L. Franklin.

CLARK—EVERETT FREDERICK JACKSON, of Toronto, Ont. Born at Hamilton, Ont., Oct. 18, 1918. Educ.: B.A.Sc., Toronto, 1947; 1938-39, (summers), foreman, McNamara Construction Co.; 1940, (summer), levelman, Dept. of Highways, Ontario; 1940-45, P O R.C.A.F.; 1946, (5 mos.), res. en r., Proctor Redfern & Laughlin; 1947, to date, sales engr., Canada Cement Co., Toronto, Ont.

References: D. O. Robinson, R. A. Crysler, J. M. Breen, E. M. Proctor, R. F. Legget, W. H. M. Laughlin, C. F. Morrison.

EADIE—ROBERT KENNETH, of Montreal, Que. Born at Montreal, Sept. 20, 1921. Educ.: B.Eng., (Elect.), McGill, 1947; R.P.E., Quebec, 1942-45, Radar Officer, R.C.A., Canadian Army; 1947 to date, Methods Engrg., Northern Electric Co., Montreal, Que.

References: C. A. Peachey, G. A. Wallace, C. V. Christie, G. J. Dodd, A. T. Bone.

GROSSKURTH—ROBERT ARTHUR, Lieut. (L) R.C.N., of Weston, Ont. Born at Toronto, Ont., Sept. 19, 1922. Educ.: B.A.Sc., (Civil), Toronto, 1945; R.P.E., Ontario; 1941-42, pole inspectr. and foreman, pole inspecn. crew, Bell Telephone Co. of Canada, Toronto; 1943, (summer), asst. to elect. supt., shipbldg. divn., Anglo-Canadian Pulp & Paper Co., Quebec; 1945, (8 mos.), Elect. Sub. Lieut., R.C.N.V.R.; 1945-46, engrg. asst. laying out and estimating cost of outside plant constrn., plant engrg. dept., Bell Telephone Co. of Canada, Toronto; 1946-47, Lieut. (L) Officer i/c Shore Elect. Mtce. H.M.C. Dockyard, Halifax, R.C.N., 1937, (7 mos.); Naval Industrial Training, Canadian Westinghouse, Hamilton, Ont.; 1947 to date, Telecoms Officer, systems and instln. of new communication equipt., both ashore and afloat, R.C.N., N.S.H.Q., Ottawa, Ont.

References: C. R. Young, A. E. Flynn, W. H. G. Roger, J. Deane, W. J. T. Wright, W. S. Wilson, M. J. McHenry.

KANEB—WILFRED, of Cornwall, Ont. Born at Worcester, Mass., April 3, 1920. Educ.: B.Sc., (Mech. Engrg.), Massachusetts Institute of Technology, 1943, (accredited E.C.P.D.); 6 mos. Aero Engrg. ourse, M.I.T.; 1943-46, Engrg. Officer U.S. Naval Air Corps; at present genl. mgr. Thomas & Nash Ltd., (real estate); vic-epres. Hy-Trous Liquid Fertilizer Corp. of Canada, Ltd., Cornwall, Ont.

References: W. P. Nesbitt, E. J. Bartley, W. H. Magwood, B. T. Yates, R. A. Rankin, G. G. M. Eastwood.

LEWIS—ARTHUR HENRY ROSS, Major, R.C.E.M.E., of Kingston, Ont. Born at Montreal, Que., Nov. 16, 1918. Educ.: B.Sc., (Chem. Engrg.), Queen's, 1941; 1941-47, R.C.E.M.E., Army, and at present, Senior Instructor, R.C.E.M.E. School, Barriefield, Ontario.

References: D. S. Ellis, W. S. Hunt, A. Jackson, H. G. Conn, K. H. McKibbin.

MACDONALD—JOHN CAMERON, of Winnipeg, Man. Born at Sydney, N.S., July 14, 1915. Educ.: B.Eng., (Mech.), Nova Scotia Tech. College, 1946; R.P.E., Nova Scotia; 1940, Sullivan Bus Service Ltd.; 1941-42, constrn., Standard Paving Maritimes Ltd.; 1945, (4 mos.) machine shop, Chiasson & Macdonald; at present, sales engr., Canadian Ingersoll Rand, Winnipeg, Man.

References: C. J. Timleck, H. W. L. Doane, W. P. Fogarty, V. T. B. Williams, M. L. Baker.

McKINNEY—ARTHUR DOUGLAS, of Toronto, Ont. Born at Toronto, Ont., March 30, 1905. Educ.: Univ. of Toronto, (Civil), 1924-28, (did not complete 4th yr.); R.P.E., Ontario (on credentials); 1925-26-27, (summers), surveying, Speight & Van Hostrand; G. S. Abrey; 1928-29, supvr. of instln. and service dept., Iron Fireman Stoker; with Arthur S. Leitch Co., Ltd., as follows: 1929-36, sales engr., 1936-43, mgr. control dept., automatic comb. control, temperature and pressure control; 1943-45, genl. sales and engrg., member board of directors, Control & Metering Ltd., Toronto; at present, Ontario rep., sales and engrg., E. F. Drew & Co. Ltd., boiler water conditioning divn., Toronto, Ont.

References: C. F. Morrison, G. L. Macpherson, J. G. Hall, W. J. Tomlinson, W. A. Bentley, C. E. Hawke.

OLSEN—OTTO, of Winnipeg, Man. Born at Hellerup, Denmark, April 5, 1917. Educ.: M.Sc., (Civil and Structl. Engrg.), Technical University of Denmark, 1940; 1940, reinforced concrete design, Hojgaard & Schultz, Copenhagen, Denmark, (engrs. and contractors); 1940-45, reinforced concrete, design and supvrn., Wright, Thomsen & Kier, engrs. and contractors, Copenhagen, Denmark; 1945-47, reinforced concrete, design and supvrn., O. Brodsgaard, Copenhagen, Denmark; 1947 to date, design of reinforced concrete constrn., Dominion Bridge Co., Ltd., Winnipeg, Man.

References: H. M. White, A. Campbell, J. C. Trueman, M. J. Lupton, J. G. Broda.

PAGE—HAROLD VERNON, of Arvida, Que. Born at Kenora, Ont., July 21, 1921. Educ.: B.A.Sc., (Chem. Engrg.), 1943; R.P.E., Ontario; 1943-46, Lieut., R.C.E.; 1946-47, chief of chemical control, laboratory, National Film Board; at present, asst. technical supvr., production control, Aluminum Co. of Canada, Arvida, Que.

References: G. M. Mason, J. F. Braun, J. T. Nichols, D. F. Nasmith, R. A. Wyman.

PATON—CHARLES PETER, of Kingston, Ont. Born at Montreal, Que., June 12, 1913. Educ.: B.Eng., (Mech.), McGill, 1935; 1930, surveyor, Shawinigan Water & Power Co.; 1932, surveyor, Canada Northern Power; with Aluminum Co. of Canada, as follows: 1935, 1 yr. dfting., 1 yr. mech. mtce., 3 yrs., tech. dept., 1941-42, supt., extrusion dept., Kingston, 1942-43, tech. director, Kingston, 1943-45, prod. supt., Kingston; 1945-46, Field Teams, British Intelligence; 1946 to date, prod. supt., Aluminum Co. of Canada, Kingston, Ont.

References: M. G. Saunders, D. L. Rigsby, C. E. Craig, R. H. Rimmer.

SANGER—FREDERICK JAMES, of Fredericton, N.B. Born at Bishops Waltham, Hants, Eng., Sept. 8, 1905. Educ.: B.Sc., (Eng.), 1928; M.Sc., (Eng.), 1938; Univ. of London; Assoc. Member, Institution Mech. Engineers; Member, American Society Civil Engineers; Assoc. Member, Inst. Civil Engineers; 1921-26, indentured shipwright apprent., Admiralty journeyman shipwright, (2 mos.), 1927, vacation job as civil engr., dftsman; 1928-29, designer R.C., etc., Christiani & Neilsen; 1929-34, Education Officer, Technical Training of R.A.F. Personnel; rank equivalent to F/Lieut.; 1934-42, head dept. of engrg. and bldg., Henry Lester Institute of Tech. Education, Shanghai, China, (position corresponding to dean in a univ., college recognized by Univ. of London for External Degree of B.Sc., Eng.); 1942-43, Executive in Relief Section, Shanghai; 1943, (6 mos.), Director Civil Assembly Office, Shanghai; 1943-45, Labour Officer in Internment Camp, Shanghai; 1947 to date, Prof. and Head Dept. of Drawing, Univ. of New Brunswick, Faculty of Applied Science, Fredericton, N.B.

References: A. F. Baird, E. O. Turner, J. H. Moore, C. A. McVey, R. A. Malloy, E. E. Wheatley.

FOR TRANSFER FROM THE CLASS OF JUNIOR

ANSLEY—RICHARD HERBERT of Slave Falls, Manitoba. Born at Winnipeg on June 25, 1920. Educ.: B.Sc. (Civil) Manitoba, 1942; Summer work as follows: 1938 and 39, instru'man. and chain man, Geodetic Survey, Manitoba Dept. Mines & Natural Resources; 1940 and 1941, inspection of asphalt concrete and stabilized mix, National Testing Laboratories, Winnipeg; 1941, asphalt foreman, Nelson River Construction Co.; 1942-45, Canadian Army Overseas, Officer, R.C.E.; at present, asst. construction engr., Power Plant, Winnipeg Hydro Elec. System. (Jr. 1944.)

References: H. L. Briggs, H. Brekke, T. E. Storey, E. P. Fetherstonhaugh, G. H. Herriot.

DOUGLAS—LLOYD ROBERT of Toronto, Ont. Born at Silverton, Man., on August 4, 1916. Educ. B.Sc. (Elect.) Manitoba, 1938. R.P.E. Ontario; with Canadian General Electric Co. as follows: 1938-39, test dept.; 1939-40, engrg. dept.; 1940, apparatus dept., head office; 1940-45, Royal Cdn. Signals, (Captain) and Staff Officer, Cdn. Army Hdqts. overseas; 1945 to date, engr. central station div., Apparatus Dept., Canadian General Electric Co., Toronto. (St. 1938. Jr. 1945.)

References: G. R. Langley, I. F. McRae, J. L. McKeever, E. P. Fetherstonhaugh, W. F. Riddell, P. W. Doddridge.

FINDLAY—ALLAN CAMERON of Montreal. Born at Montreal on Sept. 11, 1917. Educ.: B. Eng. (Mech.) McGill, 1942; R.P.E. Quebec; 1936 and 38 summers, apprentice dftsman. Dominion Bridge Co.; 1942-43, mtce. engr., The Steel Co. of Canada, i/c of various mtce. and constrn. projects; 1943-45, Royal Canadian Air Force, officer i/c aircraft mtce. sections; 1945-46, asst. production engr. responsible for planning, scheduling in machine and plate shops, Canadian Vickers; at present, production engr., Standard Brands Ltd. (St. 1937. Jr. 1945.)

References: P. E. Poitras, C. M. McKergow, R. S. Eadie, H. W. Buzzell, D. Armstrong, E. C. Kirkpatrick, E. Kingsland.

GALBRAITH—GEORGE HARSHAW, of Toronto. Born at Vulcan, Alta., on June 4, 1921. Educ.: B.Eng., (Mech.), McGill, 1945. Summer work as follows: 1940 and 41, sheet metal assemblyman, Fleet Aircraft Ltd., Fort Erie North; 1942, sheet metal layout and production, Aircraft Repair Ltd., Edmonton; 1943, civil engrg. aid, Pipeline Location, J. Gordon Turnbull and Sverdrup & Parcel, Consulting Engrs., 1944, field mgr. i/c gravity meter survey parties, The California Standard Company, Calgary; 1945-46, mech. engr. exploitation and production dept., equipt., design and layout, Shell Oil Company of Canada; two years of study, final year of Master's work at University of Toronto, holder of a James William Woods Fellowship; 1947, mech. engr.—resident engr. i/c constrn. field work, surveys, Davis, Ripley & Associates, Calgary. (St. 1943. Jr. 1946.)

References: E. H. Davis, H. A. Ripley, F. K. Beach, R. M. Hardy, E. K. Cumming, J. A. Coote, C. M. McKergow.

KNIGHT—CURTIS LAWRENCE URBAN, of St. Georges, B.W.I. Born at St. John's, Grenada, August 6, 1919. Educ.: B.Eng., (Civil), McGill, 1945. Summer work as follows: 1942, dftsman., Dominion Bridge Co.; 1943, dftsman. Horton Steel Works, Fort Erie; 1944, structural supervisor, supervising erection of reinforced concrete bridge across Sherbrooke St., Canadian National Rys. Mtl. 1945 to date, engrg. asst., designing of reinforced concrete structure, pipe line supply systems, roads, irrigation, Public Works Department, St. George's, Grenada, B.W.I. (St. 1943. Jr. 1947.)

References: G. J. Dodd, E. Brown, R. DeL. French, R. E. Jamieson.

McARTHUR—DONALD STEWART, of Sarnia, Ont. Born at Edmonton, Alta., on March 25, 1915. Educ.: B.Sc., (Chem. Engrg.), Saskatchewan, 1939, M.Sc. Univ. of Sask., 1941. Summer work as follows: 1936, Pioneer Gold Mines Ltd.; 1937, Imperial Oil Ltd., Norman Wells, N.W.T.; 1938, International Nickel Co., Coppercliff, Ont.; 1939-40, process lab. asst., British American Oil Co., Calgary; 1940-43, plant supervisor, supervision of operations on petroleum cracking, reforming, absorption and subsidiary units, Trinidad Lease Hold's Ltd., Pointe-A Pierre; Trinidad; 1943-44, senior engr., cost estimating, progress reporting, Sverdrup, Parcel & Turnbull; 1944-46, chief chemist, Madison Natural Gas Co.; at present plant supervisor, i/c operations on glycol, chlorinated hydrocarbon production, Dow Chemical of Canada Ltd., Sarnia, Ont. (St. 1938. Jr. 1943.)

References: G. W. Christie, R. W. Dunlop, B. B. Hillary, R. M. Hardy, T. S. McKeehnie, F. K. Beach.

MACNABB—THOMAS CREIGHTON, of Toronto. Born at Winnipeg on April 15, 1913. Educ.: B.Sc., (Civil), Manitoba, 1940. R.P.E. Quebec. Summer work as follows: From 1929 to 1934 working as chainman on location, laborer on construction, Canadian Pacific Railway; 1935 and 36, inspector on construction, St. John Harbour Commission; 1937, rodman, rock ballasting, C.P.R., 1938, rodman, Highway, Alberta Govt.; 1939, levelman, Highways, Alberta Govt.; 1940-43, transitman, operating Dept., C.P.R.; 1943-44, asst. engr., C.P.R.; 1944-46, asst. special engr., C.P.R., 1946, to date special engr., C.P.R., Toronto. (St. 1940. Jr. 1943.)

References: T. B. Ballantyne, W. C. E. Robinson, J. A. MacKenzie, L. C. Nesham.

MARANTZ—OSCAR, of Winnipeg. Born at Winnipeg on July 29, 1915. Educ.: B.Sc., (Civil), Manitoba, 1942; summer work as follows: 1941, asst. to city engr., St. Thomas, Ont.; 1942-43, designer, dftsman., S. & S. Aircraft, Winnipeg; 1944-45, field engr., National Testing Labs., Winnipeg; 1945-47, lecturer, Faculty of Engineering, University of Manitoba; at present, Asst. Professor of Civil Engineering, Univ. of Man. (St. 1941. Jr. 1943.)

References: A. E. Macdonald, G. H. Herriot, W. F. Riddell, E. P. Fetherstonhaugh, E. S. Magill.

PIERCY—ARTHUR KING, of St. Vital, Manitoba. Born at Winnipeg on Feb. 14, 1916. Educ.: B.Sc., (Mech.), Saskatchewan, 1942; R.P.E., Manitoba; 1935-42, summer work, machinist apprentice, Canadian Pacific Railway Co., Winnipeg; 1943-45, R.C.E.M.E. overseas; 1946, design, heating, ventilating, air conditioning, plant layout, Green Blankstein Russell, Architects and Engineers, Winnipeg. (St. 1942. Jr. 1946.)

References: I. M. Fraser, N. B. Hutcheon, C. V. Antenbring, N. M. Hall, G. H. Herriot.

SCHWARTZ—HARRY H., of Montreal, Que. Born at Montreal on October 31st, 1916. Educ.: B.Eng., McGill, 1942; S.M., (Elect.), Mass. Inst. of Tech., 1942; R.P.E. Quebec; 1938-41, Canadian Marconi Co., radio design and i/c transformer design; 1941-42, M.I.T. lab. Assistant; 1942-46, Northern Electric Co., 1943-46, lecturer evenings, McGill University; 1947 to date, lecturer evenings, Sir George Williams College; also, chief engr., Dee Electronics Ltd., Montreal. (St. 1937. Jr. 1944.)

References: L. Shector, A. Benjamin, L. Trudel, M. Stevens, C. V. Christie, A. Benjamin, A. B. Hunt.

TUTTLE—PAUL DOUGLAS, of Dewittville, Que. Born at Winnipeg, January 25, 1918. Educ.: B.Eng., (Elec.), McGill, 1940; R.P.E. Quebec; 1940-42, relayman, Montreal Light, Heat & Power Consolidated; 1942-44, general engr., The Foxboro Co. Ltd.; 1945 to date, engr., design div., Quebec Hydro Electric Commission. (St. 1940. Jr. 1946.)

References: T. O. Evans, W. E. Cooper, H. W. Haberl, L. H. Marrotte, R. M. Walker.

LIBRARY NOTES *(Continued from page 569)*

frames, the following methods are developed; area moments, strain energy, slope deflection, moment distribution, influence lines, and the column analogy. The book is profusely illustrated with graphs and diagrams.

SYMPOSIUM ON OIL PROCUREMENT PRACTICES, 49th Annual Meeting of American Society for Testing Materials, Buffalo, N.Y., June 24-28, 1946.

American Society for Testing Materials, 1916 Race St. Philadelphia 3, Pa., 1946. 53 pp., illus., diagrs., charts, tables, 9 x 6 in., paper, $1.00 to members $.75.

Six papers cover actual or recommended practices on the purchasing of oils and lubricants by various industrial firms and government departments. A general discussion section follows the papers.

TALKS ABOUT STEELMAKING:

By H. Brearley. American Society for Metals, Cleveland, Ohio, 1946. 236 pp., illus., diagrs., charts, tables, 9¼ x 6 in., cloth, $3.50.

A steelman discusses informally a wide range of topics within his field. From the chemical laboratory to the work bench, from the melting furnace to the forge shop, from the handling of materials to the handling of men, the author finds something of interest to be considered. As often as not, he ends his chapters with questions, real or implied, which are more or less a challenge to the industry.

WRITING SCIENTIFIC PAPERS AND REPORTS:

By W. P. Jones. Wm. C. Brown Company, Dubuque, Iowa, 1946. 115 pp., diagrs., 11 x 8¼ in., paper, spiral binding, $2.50.

The general intent of this text is to present students with a number of simple problems in scientific exposition, and to give them instruction and practice in organizing ideas and in communicating these ideas to the reader. Necessary information concerning writing style, sentence structure, punctuation, capitalization, abbreviations, etc., is included, as well as the proper physical characteristics of technical reports and other examples of written expression.

YOUR CITY TOMORROW:

By G. Greer. The Macmillan Company, New York, 1947. 210 pp., maps, 8¼ x 5¼ in., cloth, $2.50.

This book gives a general history of the growth of cities and the methods used to combat decentralization, blight and slums, and threatened fiscal breakdown. A description is given of the efforts of the last fifty years to cope with the urban problem. Urban housing, the money problem, and plans for the future rehabilitation of urban areas are dealt with. Special mention is made of Boston's comprehensive plans for reorganization.

Employment Service

The service is operated for the benefit of members of The Engineering Institute of Canada, and for industrial and other organizations employing technically trained men—without charge to either party. It would therefore be particularly appreciated if employers would make the fullest possible use of these facilities to make known their existing or estimated requirements. Notices appearing in the Situations Wanted column will be discontinued after three insertions, and will be inserted upon request after a lapse of one month. Personal interviews by appointment.

Situations Vacant

CIVIL

CIVIL ENGINEER, recent graduate, required in Montreal for Construction work, setting up of machinery, general engineering. Salary $200. Apply to File No. 3949-V.

ELECTRICAL

JUNIOR ELECTRICAL ENGINEER, age about 30, required as assistant to Superintendent of Light Department in Montreal area. Practical experience in Hydro Distribution and Steam Turbines. General office routine of administrative nature. Salary open. Apply to File No. 3950-V.

MISCELLANEOUS

MECHANICAL ENGINEER OR ELECTRICAL ENGINEER with mechanical experience, recent graduate up, required in engine and power plant section of aircraft division in Montreal area. Duties include design, service analysis and general installation work. Salary according to experience. Apply to File No. 3948-V.

INDUSTRIAL ENGINEER, thoroughly experienced in time study, standard data and wage incentive installation and administration required for firm in Quebec. Salary open. Apply to File No. 3952-V.

JUNIOR ENGINEER required as Assistant Manager of Montreal office of a Toronto firm specializing in Metallic Waterproofing of buildings and asphalt industrial flooring. Some experience in construction materials preferred. Duties include field supervision also some office routine. Salary according to qualifications. Apply to File No. 3953-V.

The following advertisements are reprinted from last month's Journal having not yet been filled.

CHEMICAL

CHEMICAL ENGINEER OR CHEMIST, preferably with Ph.D., required by a pulp and paper company with plants in Eastern Canada, for research work. Salary open. Apply to File No. 3549-V.

CHEMICAL ENGINEER required by a pulp and paper company with plants in Eastern Canada, for mill control and pilot plant work. Salary open. Apply to File No. 3549-V.

CHEMICAL ENGINEER required for the control department of a paper mill in Shawinigan Falls. Salary from $250-350. Apply to File No. 3765-V.

CHEMICAL ENGINEER OR CHEMIST interested in textile dyeing, required by an industrial firm in South Western Quebec. Salary open. Apply to File No. 3798-V.

CHEMICAL ENGINEER, required by a chemical firm in Shawinigan Falls, Que., for development work on plastics. Salary open. Apply to File No. 3812-V.

CHEMICAL METALLURGIST with background in extraction metallurgy and ore dressing (knowledge of minerology desirable) and experience in use of petrographic microscope. Required for research work in B.C. Maximum salary $4,000. Apply to File No. 3865-V.

CHEMIST, recent graduate, required by manufacturer in central Ontario as shift chemist in Analytical Laboratory. Training emphasis on Organic, Physical and Inorganic Chemistry. Starting salary $225. Apply to File No. 3911-V.

CHEMISTS, recent graduates, required by manufacturer in Central Ontario for research Department. Duties would be independent research under supervision. Salary $225. Apply to File No. 3911-V.

CHEMICAL ENGINEER with considerable mechanic and hydraulic experience or mechanical engineer with good chemical knowledge and experience in hydraulics, required by a manufacturer in Ontario. Salary open. Apply to File No. 3928-V.

CHEMICAL ENGINEER OR CHEMIST required by a Pulp and Paper Mill in Ontario to develop, install and directly supervise the operation of technical control systems for raw material, inspection, process control, quality reporting, inventory, measurement and product satisfaction. Salary open. Apply to File No. 3938-V.

CHEMICAL ENGINEER OR CHEMIST required as Technical Superintendent to administer the Technical Department of a Pulp and Paper Mill in Ontario. Minimum of 5 years in technical or production work in the pulp and paper industry. Salary open. Apply to File No. 3938-V.

CHEMICAL ENGINEER required by Pulp and Paper Mill in Ontario to undertake the solution of manufacturing and technical control problems etc. Preferably experience in the pulp and paper industry. Salary open. Apply to File No. 3938-V.

CIVIL

CIVIL ENGINEER to take charge of work in a drainage district in Quebec. Must be bilingual. May be recent graduate. Salary from $200. Apply to File No. 3479-V.

CIVIL ENGINEERS with experience in detailing and designing structural steel and reinforced concrete for manufacturers are required for a steel fabricating company in Manitoba. Salary open. Apply to File No. 3519-V.

CIVIL ENGINEER, recent graduate up, required by a pulp and paper company with plants in Eastern Canada. Salary open. Apply to File No. 3549-V.

CIVIL ENGINEER, age 35-40, extensive experience in detailing and checking structural steel in buildings and bridges, required by a steel fabricating company in Southern Ontario. Salary open. Apply to File No. 3570-V.

CIVIL ENGINEERS AND ASSISTANT HYDRAULIC ENGINEERS required for government organization on West Coast for highway and construction. Salary open. Apply to File No. 3724-V.

CIVIL ENGINEER, qualified O.L.S., required as town engineer and superintendent of works for a town in Central Ontario. State age and salary desired. Apply to File No. 3750-V.

GRADUATE CIVIL ENGINEER, required by a public utility in the Montreal area with three or four years experience in design of reinforced concrete and structural steel. Salary $250-$300. Apply to File No. 3766-V.

GRADUATE CIVIL ENGINEER, required as structural designing engineer by a firm engaged in the manufacture of cranes, crushers, pumps etc., in the Toronto area. Preferably with 5 to 10 years experience in designing and detailing steel buildings and bridges. Salary open. Apply to File No. 3771-V.

GRADUATE CIVIL ENGINEER required by an industrial corporation in Montreal for design work in draughting room. Must be familiar with structural steel and concrete design. Salary from $250 up according to experience. Apply to File No. 3785-V.

CIVIL ENGINEERS with some experience on design and field work required by a public utility in Toronto. Salary open. Apply to File No. 3813-V.

CIVIL ENGINEER, age 35-40, with considerable experience in design of structures, water supply, sewers, required by an organization in Montreal. Salary $300-$400. Apply to File No. 3820-V.

2 CIVIL ENGINEERS AND 2 DRAUGHTSMEN required by an industrial organization for design and detailing of reinforced concrete for Hydro Electric developments. Location Montreal. Salary open. Apply to File No. 3864-V.

CIVIL ENGINEER, recent graduate, must be bilingual, required for public utility in Quebec City. Salary open. Apply to File No. 3878-V.

CIVIL ENGINEERS required as draughtsmen in bridge department of large transport company. Preferably with experience in steel, concrete and timber construction. Location Montreal. Salary $200-$300. Apply to File No. 3884-V.

CIVIL ENGINEER, required in New Brunswick. Must be qualified designer of miscellaneous public utility buildings in frame and masonry construction. Thorough working knowledge of timber, reinforced concrete and steel framing essential. Knowledge of the design of various types of heating systems and plumbing. Salary open. Apply to File No. 3887-V.

CIVIL OR STRUCTURAL ENGINEER, 24-35 years, required for Northern Ontario Paper Mill. At least 2 years construction and 2 years design experience. Opportunity to train junior personnel. Salary not less than $350. Apply to File No. 3891-V.

CIVIL ENGINEER, required by a firm in the St. Maurice Valley to be in charge of improvements in woods operations such as dams, bridges, roads, etc. Must be bilingual. Salary $350. Apply to File No. 3902-V.

CIVIL ENGINEER required as Town Engineer of a town in the Maritimes. Required to supervise and lay out work for Water and Sewerage Department, Works Department, also construction of a general nature for the Electric Light Department. Salary open. Apply to File No. 3930-V.

CIVIL ENGINEER, required by a steel company in Montreal for the design of reinforced concrete frame. Salary open. Apply to File No. 3931-V.

ELECTRICAL

ELECTRICAL ENGINEER, age 32-36, with electrical experience around mines or smelters, English speaking with working knowledge of French, is required by a company in Shawinigan Falls, Que. Salary open. Apply to File No. 3415-V.

ELECTRICAL ENGINEER, age 30-45, with sales training with large manufacturer of electrical equipment instruments and 5-10 years experience as sales service and sales engineer, required as sales engineer in Canada for U.S. firm making special equipment for transport and industry. Salary open. Apply to File No. 3447-V.

ELECTRICAL ENGINEER, recent graduate, required for the engineering staff of a paper mill in the Lake St. John area. Salary open. Apply to File No. 3507-V.

ELECTRICAL ENGINEER with knowledge of power apparatus, preferably bilingual, required for sales work with a manufacturer in the Montreal area. Salary open. Apply to File No. 3646-V.

ELECTRICAL ENGINEER with considerable industrial experience required as a safety engineer by a public utility in the Montreal area. Bilingual preferred. Salary open. Apply to File No. 3654-V.

ELECTRICAL ENGINEER, with general knowledge of A.C. and D.C. motors, switch gear, mercury rectifiers, transformers and other electrical apparatus, for sales work in Eastern Canada. Age 30 to 35. Salary open. Apply to File No. 3695-V.

ELECTRICAL DRAUGHTSMEN with several years experience in industrial layouts for large concern in Eastern Townships. Permanent position and attractive salary available for experienced men. Apply to File No. 3701-V.

ELECTRICAL ENGINEER, age about 30, with considerable experience, required by a manufacturer in the St. Maurice Valley. Salary open. Apply to File No. 3723-V.

ELECTRICAL ENGINEER, required by an insurance company, preferably with a few years practical experience for the inspection of boilers, steam plant and allied equipment in Montreal area. Salary open. Apply to File No. 3754-V.

ELECTRICAL ENGINEER, recent graduate up, required by a manufacturer in Montreal for sales engineering. Preferably bilingual and familiar with rotating electrical equipment. Salary $200 up. Apply to File No. 3761-V.

GRADUATE ELECTRICAL ENGINEERS, with 3 to 10 years experience in design, operation, layout of substations, switching stations, and electrical machinery together with engineering studies, including draughting for a large Hydro Electric power house in Quebec. Salary $225 up according to experience. Apply to File No. 3787-V.

ELECTRICAL ENGINEER required for power sales by an electrical utility in Province of Quebec. Preferably experienced. Bilingual. Salary open. Apply to File No. 3802-V.

ELECTRICAL ENGINEERS, with experience in layout and design of generating and transformer stations, required by a public utility in Toronto. Salary open. Apply to File No. 3813-V.

ELECTRICAL ENGINEER, under 30, required as sales engineer of switchgear, electrical and power-house equipment by a manufacturer in Montreal. Considerable travelling. Salary $4,000, plus expenses. Apply to File No. 3885-V.

SEVERAL EXPERIENCED ELECTRICAL DRAUGHTSMEN for the design and layout of industrial power and control systems. Required by consulting engineering office in Montreal. Salary open. Good chance for advancement. Apply to File No. 3890-V.

GRADUATE ELECTRICAL ENGINEER, 3 to 5 years experience, preferably in industrial electric power applications and electric control. Required by consulting engineering office in Montreal to act as assistant to the electrical engineer on design of a large industrial project. Salary open. Apply to File No. 3890-V.

JUNIOR ELECTRICAL ENGINEER, with practical experience in general manufacturing industries, required by an industrial organization in Ontario. Salary open. Apply to File No. 3904-V.

ELECTRICAL ENGINEER, recent graduate, required by a paper company for work in mill equipment and power generators. Salary $225. Apply to File No. 3906-V.

ELECTRICAL ENGINEER, required as Assistant Superintendent, Light and Power Department, Saskatchewan City. Must have several years experience in Utility field. Minimum starting salary $3,600. Apply to File No. 3913-V.

ELECTRICAL ENGINEERS, required for sales engineering work in Western Canada. Graduates with some selling experience preferred. Salary open, plus expenses. Apply to File No. 3915-V.

ELECTRICAL ENGINEER, recent graduate, required in Montreal for general engineering on telephone and radio. Salary $175-$225. Apply to File No. 3923-V.

ELECTRICAL DRAUGHTSMAN required in Newfoundland for general industrial power installation. Salary $350. and board. Apply to File No. 3941-V.

ELECTRICAL ENGINEER wanted for new Chemical Plant in Western Ontario. Engineer must have had previous Electrical Rectification experience. Salary open. Apply to File No. 3945-V.

MECHANICAL

MECHANICAL ENGINEERS, preferably with design experience, are required for armament research and development in the Quebec area, in a government establishment. Salary from $190. Apply to File No. 3401-V.

MECHANICAL ENGINEER with experience in pulp and paper or mining work required by a pulp and paper company with plants in Eastern Canada. Salary open. Apply to File No. 3549-V.

GRADUATE MECHANICAL ENGINEERS required for Sessional appointment as Instructors for 8 months and Demonstrators for 7 months. Salary open. Apply to File No. 3600-V (I).

MECHANICAL ENGINEER with experience in the fabrication of Farm Implements, required by a Quebec firm. Bilingual man preferred. Salary according to experience. Apply to File No. 3666-V.

MECHANICAL ENGINEER with design experience in the pulp and paper industry required by a firm in the St. Maurice Valley. Salary $350. Apply to File No. 3673-V.

JUNIOR MECHANICAL ENGINEER with knowledge of precision machine shop practice and aptitude for research work in metals and plastics required for an organization in Toronto for the production of artificial limbs. Must be veteran. Salary from $225. Apply to File No. 3675-V.

MECHANICAL ENGINEERS with at least five years experience in the pulp and paper industry required by an Ontario Paper Company. Salary open. Apply to File No. 3733-V.

MECHANICAL ENGINEER with experience in heating, ventilating and air-conditioning required by a consulting engineer in Montreal. Salary open. Apply to File No. 3773-V.

MECHANICAL ENGINEER with considerable experience willing to act as assistant to Mechanical Superintendent of a textile manufacturing concern near Montreal. Salary open. Apply to File No. 3784-V.

MECHANICAL ENGINEERS required by a pulp and paper mill at Powell River, B.C. Preferably with experience in plant design in the pulp and paper industry. Salary according to qualifications. Apply to File No. 3796-V.

RECENT GRADUATES OR JUNIOR ENGINEERS with mechanical background, required by a Montreal Engineering, fabricating and contracting firm for training purposes leading to sales and service. Area Montreal. Salary $175 up. Apply to File No. 3810-V.

MECHANICAL ENGINEERS with experience in plant layout and design or ventilation problems or general mechanical design, required by a firm in Quebec. Salary from $250. Apply to File No. 3818-V.

MECHANICAL ENGINEER, age 35-40 with considerable experience in design and layout of machinery and equipment, required by an organization in Montreal. Salary $300-$400. Apply to File No. 3820-V.

MECHANICAL ENGINEER, required by a manufacturer in Ontario for the plant operation staff. Salary open. Apply to File No. 3833-V.

MECHANICAL ENGINEER with six to ten years experience in maintenance and engineering work required by alkali manufacturers in Ontario. Salary open. Apply to File No. 3833-V.

MECHANICAL ENGINEER, recent graduate up, required by a company in Montreal for toll design. Salary $175 up. Apply to File No. 3843-V.

MECHANICAL ENGINEER with knowledge of physical metallurgy, heat treatment, ability in stress analysis and design. Required for research work in B.C. Maximum salary $4,000. Apply to File No. 3865-V.

MECHANICAL ENGINEER, age 30-38, required for northern Ontario paper mill. Preferably with paper mill experience or experience in general layout and design. Knowledge of pumps, capacities, piping, conveyors, estimating and structural design essential. Salary open. Apply to File No. 3891-V.

MECHANICAL ENGINEER, bilingual, with 4 or 5 years experience in sheet metal work required as Plant Manager by a manufacturer in the Province of Quebec. Salary open. Apply to File No. 3894-V.

MECHANICAL ENGINEER required by a firm of Power House and Building Specialists to act as representative in the Toronto Territory. Must be familiar with that district. Preferably manufacturers' agent to act as sub-agent. Apply to File No. 3897-V.

RECENT GRADUATE, mechanical background, required by a manufacture in Montreal for duties leading to production. Salary $225. Apply to File No. 3901-V.

MECHANICAL ENGINEER, age 25 to 35, experienced in industrial plant layout and machine design required by manufacturing firm in Brantford. Salary open. Apply to File No. 3907-V.

MECHANICAL DRAUGHTSMAN required in Newfoundland must have enough experience to do piping and equipment layout work. Salary $350. and board. Apply to File No. 3941-V.

MINING

MINING ENGINEERS, with varied experience required by a firm in Quebec for general mine operation, exploitation and development work. Salary from $250. Apply to File No. 3818-V.

MINING ENGINEER with several years experience required by a company engaged in large scale asbestos production in Quebec. Salary open. Apply to File No. 3935-V.

MISCELLANEOUS

MANAGEMENT ENGINEERS with business administration and mechanical background, age 30 up, bilingual with at least 5 years practical experience, required by an industrial engineering consultant in Montreal. Salary open. Apply to File No. 3307-V.

STRUCTURAL STEEL DRAUGHTSMAN AND CHECKERS, preferably graduate engineers but any experienced men acceptable, are required for a steel fabricating company in Manitoba. Salary open. Apply to File No. 3519-V.

ASSISTANT PLANT ENGINEER with paper mill experience required by a pulp and paper company with plants in Eastern Canada. Salary open. Apply to File No. 3549-V.

GRADUATE ENGINEERS required by an industrial and chemical organization with headquarters in Montreal for all phases of research, design, operation, development, production and maintenance. Salaries open. Apply to File No. 3588-V.

CHIEF ENGINEER with industrial experience required for a steel fabricating plant in Western Canada. Salary open. Apply to File No. 3616-V.

DESIGN DRAUGHTSMAN for the design of cranes and hoists of all types, capable of making and checking complete manufacturing detail drawing, required by a manufacturer in Southern Ontario. Apply by letter with full details. Salary open. Apply to File No. 3628-V.

SALES ENGINEER with wide engineering experience, wanted by a company in Toronto for the sale of textile machinery and construction equipment. Salary open. Apply to File No. 3639-V.

JUNIORS ENGINEERS, recent graduates up, as designing draughtsmen for a brewing company with headquarters in Montreal. Salary from $200. Apply to File No. 3670-V.

CHEMICAL OR METALLURGICAL ENGINEERS, from recent graduates up, required by a Quebec firm engaged in metal production for employment as production and development engineers. Salaries open. Apply to File No. 3693-V.

MINING AND METALLURGICAL ENGINEER, age about 30, with considerable experience, required by a manufacturer in the St. Maurice Valley. Salary open. Apply to File No. 3723-V.

CONSTRUCTION ENGINEER with considerable experience required for the permanent staff of a Montreal inspection company. Salary about $200. Apply to File No. 3728-V. Age immaterial.

STRUCTURAL STEEL DETAILER AND CHECKER with considerable experience, required for checking shop details by a steel fabricating firm in Montreal. Salary open. Apply to File No. 3740-V.

DETAILER AND DESIGNER, for reinforcing steel with considerable experience, required by a steel fabricating firm in Montreal. Salary open. Apply to File No. 3740-V.

SALES ENGINEER, preferably bilingual, required by a Montreal firm dealing in building materials. Salary from $200. Apply to File No. 3745-V.

PUBLICITY ENGINEER required by an electrical firm in Montreal, to organize publicity department and edit trade journal. Salary open. Apply to File No. 3751-V.

CHIEF DRAUGHTSMAN with experience in Pulp and Paper Mill design wanted immediately in Port Arthur. Reply stating education, experience. Salary open. Apply to File No. 3760-V.

CIVIL, MECHANICAL OR CHEMICAL ENGINEERS, recent graduates up, preferably with experience in petroleum and heavy industry such as chemical or paper, required by an oil company in Toronto. Salary open. Apply to File No. 3762-V.

STRUCTURAL STEEL DRAUGHTSMAN, qualified to detail and check all classes of structural steel and to supervise draughtsmen in a large drawing office on the West Coast. Salary open. Apply to File No. 3777-V.

GRADUATE CIVIL OR MECHANICAL ENGINEERS with 3 to 10 years experience in design, cost estimates, draughting and engineering studies for a large hydro electric power house in Quebec. Salary $225 up according to experience. Apply to File No. 3787-V.

STEAM PLANT ENGINEER for large concern in Eastern Townships, with at least 5 years practical experience. Must be familiar with thermo-dynamics, combustion control, steam turbines, mechanical refrigeration, hydraulics, etc. Permanent position and attractive salary for the right man. Apply to File No. 3791-V.

STRUCTURAL ENGINEER required by a firm of consulting engineers in Montreal for design work. Must have experience in structural steel and reinforced concrete. Salary open. Apply to File No. 3811-V.

GRADUATE ENGINEER, preferably with chemical and industrial experience, required to supervise operations at the Sodium Sulphate Plant now being constructed at Chaplin, Saskatchewan. Apply to File No. 3821-V.

DRAUGHTSMEN required by a pulp and paper mill in the Eastern Townships for general draughting and detailing. Three or four years experience preferred but not essential. Salary open. Apply to File No. 3823-V.

DRAUGHTSMAN, preferably with mechanical background, required by a manufacturer in Montreal for design work on electrical equipment. Salary open. Apply to File No. 3829-V.

GRADUATE ENGINEER, age 35-40, with 10 years experience in building construction and general contracting work, to supervise design construction and maintenance of structures for Public Utility in Toronto. Permanent job. Salary open. Send photo and full particulars of education and experience. Apply to File No. 3847-V.

CITY ENGINEER required by City of Moose Jaw, Saskatchewan. Salary open. Apply to File No. 3856-V.

JUNIOR INDUSTRIAL ENGINEER with mechanical or chemical background, preferably with knowledge of chemical plants, required in Montreal. Salary $250. Apply to File No. 3857-V.

DRAUGHTSMEN of the following classes: Architectural, piping layout, equipment layout, mechanical design, steam plant, heating and ventilating, electrical and plumbing required by an industrial organization in Montreal. Salaries open. Apply to File No. 3860-V.

STRUCTURAL STEEL CHECKER AND ONE DETAILER CHECKER wanted for large fabricating plant in Vancouver, B.C. Age between 30 and 40 years preferred. Must be experienced. Give full information and references. Salary open. Apply to File No. 3862-V.

MECHANICAL, CHEMICAL OR CIVIL ENGINEER, recent graduate up, required for sales and service in Alberta by a Montreal manufacturer. Salary open. Apply to File No. 3867-V.

CIVIL OR MINING ENGINEER with executive ability required by a construction firm in Quebec to supervise highway construction. Must be bilingual. Permanent position. Salary $300-$500. Apply to File No. 3877-V.

MECHANICAL OR CHEMICAL ENGINEER, recent graduate, required by a firm in Montreal. Ability to do simple drawings, such as layout of piping and instruments. Some experience in oil refinery or chemical plant or pulp and paper would be useful. Position to eventually lead to sales. Salary $200. Apply to File No. 3879-V.

GRADUATE ENGINEERS required for all phases of Research, design, operation and development by an industrial organization in Montreal. Salaries open. Apply to File No. 3882-V.

SALES ENGINEERS required by established Canadian Manufacturer of fabricated steel products. Some construction experience an advantage. Wanted for Maritimes, Ontario and Manitoba. Salaries open. Apply to File No.3883-V.

GRADUATE ENGINEER, familiar with industrial processes, metallurgical and chemical engineering as applied to steel, copper, mining and chemical plants. Broad general experience in estimating and designing. Salary open. Toronto area. Apply to File No. 3886-V.

INDUSTRIAL ENGINEER preferably with mechanical background and several years experience in time studies, estimating etc. Required by a manufacturer in Montreal. Salary $250. up according to experience. Apply to File No. 3893-V.

STRUCTURAL ENGINEER preferably a graduate civil engineer with experience in the design of mill buildings required by a paper manufacturer in Eastern Ontario. Salary open. Apply to File No. 3896-V.

SALES ENGINEER, mechanical background, preferably with experience in refrigeration field, required by a Montreal firm. Salary $250-$300. Considerable travelling. Apply to File No. 3898-V.

RECENT GRADUATES required by an industrial organization in Montreal for training in Purchasing department. Salary $200. Apply to File No. 3900-V.

DETAILERS OR JUNIOR DESIGNERS on mechanical or sheet metal design required by an industrial organization in Ontario. Salary open. Apply to File No. 3904-V.

INDUSTRIAL ENGINEERS preferably with mechanical background, required as Management Superintendents by a firm of industrial consultants in Montreal. Experience in time study, cost control etc. Salary $300-$400. Apply to File No. 3910-V.

RECENT GRADUATES in electrical or mechanical engineering can still be offered the opportunity of being trained by large Hydro-Electric Utility. Very good opportunities for regular employment in various departments at the completion of training period. Minimum salary 1st year $200; 2nd year $215. Apply to File No. 3912-V.

CIVIL OR MECHANICAL ENGINEER interested in the sales and engineering of power transmissions, gravity conveyors and grain separators, required in Western Canada. Salary open. Apply to File No. 3915-V.

GRADUATE ENGINEER OR PHYSICIST, bilingual, preferably with knowledge of X-Ray required by Canadian office of worldwide electronic concern to manage X-Ray application engineering activities. Salary $2,700 to $3,600. or more depending on qualifications. Apply to File No. 3917-V.

JUNIOR ENGINEER with some structural experience required by large milling company with headquarters in Toronto for design work on flour and feed mill buildings and equipment. Salary open. Apply to File No. 3918-V.

GRADUATE ENGINEER required by a specialized industrial plant in the Montreal area to head up Production Department. Suitable applicant should be good organizer with plenty of initiative and preferably with machine shop production experience. Salary $300 up. Apply to File No. 3924-V.

JUNIOR ENGINEER preferably with some practical machine shop or mechanical, electrical or automotive maintenance experience required in Montreal as assistant to Superintendent of Equipment on testing, investigation and designing in connection with the repair and maintenance of Car Trolley Coach and Bus Rolling Stock units and equipment. Salary open. Apply to File No. 3925-V.

AERONAUTICAL ENGINEER required in Montreal with 5 years experience in aircraft industry of which 3 years should have been in aerodynamics work and 2 years in advanced flight test reduction or performance analysis. Salary open. Apply to File No. 3926-V.

GRADUATE ENGINEER from a recognized University, preferably in the field of Applied Science, with a few years of industrial experience and fluently bilingual, possession or ability to obtain an automobile for transportation essential. Required in Montreal. Salary open. Apply to File No. 3927-V.

AERONAUTICAL OR MECHANICAL ENGINEER required for service engineering work on aircraft, engine and accessory overhaul in Winnipeg by large aircraft operator. At least 2 or 3 years of Air Force, air line or aircraft manufacturing experience required. Salary $200-$300 depending on experience. Apply to File No. 3929-V.

GRADUATE ENGINEER, mechanical, electrical or civil, about 30 years of age, required by a large Hydro-Electric Utility in Montreal for field testing hydraulic turbines. Salary open. Apply to File No. 3932-V.

RECENT GRADUATE required by a Montreal contractor for survey and making of plans. Must be bilingual. Salary $175 up according to experience. Apply to File No. 3933-V.

TOWNSITE ENGINEER OR MANAGER required by an Ontario Pulp and Paper Mill. Townsite part under construction. Salary open. Apply to File No. 3936-V.

RECENT GRADUATE willing to learn and study in detail the welding industry, required by an industrial organization in Montreal. Salary open. Apply to File No. 3937-V.

MECHANICAL OR CHEMICAL ENGINEER required by a Pulp and Paper mill in Ontario to secure continuous optimum performance from all process instruments, maintenance of instruments, etc. Salary open. Apply to File No. 3938-V.

Sales Engineer Wanted

by well-known manufacturer of mechanical equipment to solicit industrial accounts throughout the province of Quebec.

Applicants must state age, training, marital status, past and present connections as well as salary expected.

Our staff are aware of this vacancy.

Only letters giving full details will be considered.

Apply to File No. 3951-V.

SALES ENGINEER required for the Toronto office of a large industrial firm. Preferably with mechanical background. Excellent future for suitable candidate. Must be resident of Toronto. Salary open. Apply to File No. 3939-V.

TWO METALLURGICAL ENGINEERS AND ONE CHEMICAL ENGINEER required by large metallurgical firm in the Maritimes. Good opportunity for advancement in Research, Development and Production. Salary open. Apply to File No. 3942-V.

MECHANICAL ENGINEER with construction experience or Civil Engineer with some mechanical background required in Montreal for maintenance of construction plant and machinery. Salary $300. Apply to File No. 3943-V.

SENIOR DRAUGHTSMAN preferably with pulp and paper experience required by a paper manufacturer for work in Montreal. Must have general engineering knowledge. Salary open. Apply to File No. 3944-V.

Situations Wanted

CONSULTING ENGINEER, M.E.I.C., Prof. Eng. Que., Mech. '30 McGill, newly established not fully occupied available to assist others short of staff. Present contracts in woodworking industry and commercial buildings and experience in industrial research, mechanical and heating equipment, cost studies, organization and factory layout. Apply to File No. 631-W.

GRADUATE CIVIL ENGINEER, M.E.I.C., over 20 years experience in U.S.A. and Canada as designer and Superintendent of construction of dams and hydraulic Power Plants. Desire responsible position in well established firm where extensive construction is contemplated. Location immaterial. Now employed, but available. Apply to File No. 1527-W.

GRADUATE CIVIL ENGINEER, Jr. E.I.C., P. Eng. (Ont.) with wide experience in building construction and design, desires spare time employment evenings and weekends on design of reinforced concrete, steel and masonry structures, preferably on a fee basis. Location Toronto. Apply to File No. 2581-W.

ELECTRICAL ENGINEER, B. Eng. Honors, McGill 1943, Jr. E.I.C., A.I.R.E. Prof. Eng. (Que.) 26, married, presently employed, desires change to smaller organization with more general scope, broader future responsible outlook, in Ontario or B.C. Experience in heavy manufacturing, radio production, standardization, specifications, audio design. Apply to File No. 2727-W.

CHEMICAL ENGINEER, Jr. E.I.C., McGill, age 27, married. Experienced manager, in charge personnel, production, purchasing. Synthetic resin research, distillation. Plant and laboratory control. Time study. Sales. Available immediately. Bilingual. $4,500 year last position. Apply to File No. 2850-W.

RECENT GRADUATE, S.E.I.C., Toronto 1947, Metallurgical Engineering. Desires position in Central or Western Ontario to gain experience in production. Interested also in Industrial Relations and Engineering. Previous experience in aircraft and farm implement manufacture. Apply to File No. 2888-W.

STEAM-ELECTRIC POWER PLANT ENGINEER, 38, B.Sc., M.E.I.C., A.M.I.E.E., 3 years manufacturing, installation, and sales office experience in metalclad switchgear, protective equipment, instruments, motors, etc. 9 years practical and administrative experience in operation and maintenance of Power Plant Electrical Equipment, high and extra high pressure large capacity chain grate and pulverized fuel water tube boilers, condensing turbines, and associated apparatus. Available November 1st. Apply to File No. 2891-W.

MINING ENGINEER—GEOLOGIST, M.Sc., M.E.I.C.. Age 35. Eight years experience in mining industry; some chemical, mechanical, industrial experience. Desires position with progressive manufacturing firm in Alberta or B.C. Industrial minerals field preferably. Willing to invest in sound business. Available one month. Apply to File No. 2892-W.

GRADUATE ENGINEER, P. Eng. (Que.), S.E.I.C., B.Sc.A. from Ecole Polytechnique, Montreal, Bilingual, would accept part time work during evenings and week-ends, at home preferably. Specialized in heating problems, including Forced Hot Water Systems, Low Pressure Steam Systems and Air Conditioning. Presently employed and residing in Montreal area. Apply to File No. 2898-W.

CHEMICAL ENGINEER, B.A.Sc. Toronto '43, Jr.E.I.C., age 28, married; 4 years experience including chemical process equipment installations, maintenance, manufacturing methods and laboratory control in a large manufacturing company. Interested in a change of employment which would offer more scope in the chemical field. Prefer Ontario location. Available 1 month's notice. Apply to File No. 2901-W.

JUNIOR ELECTRICAL ENGINEER, Jr.E.I.C., P.E.Q., age 28, married. Actually on the staff of the Electrical Department of a Canadian University, would prefer work in industry. Experience in electrical machinery and meters. Available one month's notice. Apply to File No. 2902-W.

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COVER PICTURE

St. Maurice Power Corporation's 225,500 horsepower development at La Tuque, Quebec, in Christmas garb.

APPLIED SCIENCE IN A CHANGING WORLD

C. J. MACKENZIE, hon.m.e.i.c.
President, National Research Council of Canada, Ottawa, Ont.

An address delivered at the Annual Banquet of the Diamond Jubilee Meeting of The Engineering Institute of Canada, Royal York Hotel, Toronto, Ont., May 9, 1947.

Sixty years is a considerable period in the life of an individual but in the history of human progress it is but a microsecond. The past sixty years have been full of scientific adventure and progress but I am sure most of you feel with me that the application of science "for the use and convenience of man" is still very much in its youth and that the young graduate of to-day can look forward to a life of professional adventure as exciting as any generation has known.

This afternoon three able papers[1] were presented on the past, the present and the future of The Engineer and the Community and we were most fortunate in being able to listen to a distinguished Canadian engineer as he brought us personal recollections of conditions existing in 1887, the year the old Canadian Society of Civil Engineers came into being. As one listened to the speeches it was difficult to believe that so much could have happened in only three score years, and to realize that when the old society was formed many, perhaps most of the fields of engineering which now claim a large membership did not exist. Our founders certainly lived in a world that in retrospect appears to have been alluringly simple.

I read a few days ago a clipping from a Boston newspaper written only a few months before Alexander Graham Bell first spoke over a telephone wire. The editorial said that one Joshua Coppersmith had been arrested in New York "for attempting to extort funds from ignorant and superstitious people by claiming he had a device which would convey the human voice over metallic wires" and the editor continued "well informed people know that it is impossible to transmit the human voice over wires as may be done with dots and dashes and signals of the Morse Code and, were it possible to do so, the thing would be of no practical value". So much for the pontifical prophets of scientific progress. One really should be careful about the future.

At about the time our Institute was being founded, a distinguished official in America reported formally that the era of rapid industrial advance had ended for the then-civilized world; that there would be no further opportunities such as the 19th century offered and the only thing remaining was the work of consolidating the gains already made. Yet, at that moment, there was being ushered in a period of still more amazing developments.

How history does repeat itself, for similar Jeremiahs are repeating in 1947 models the same views and they will probably be just as wrong.

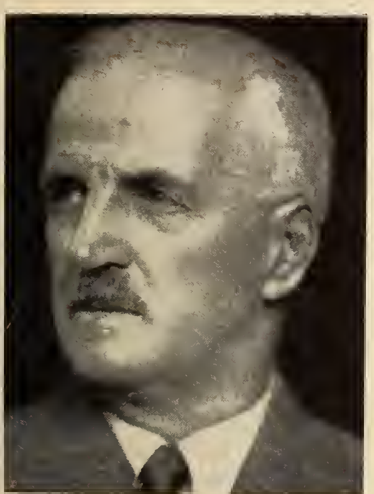
After saying this, one must admit there are difficult problems before the world to-day, and they are serious indeed. Whether or not spiritually, morally and socially this world can keep abreast of the pace of science often seems questionable, but I find it difficult to believe, as some economic pessimists do, that the solution is to slow down the vigorous member of the team rather than speed up the partner that finds difficulty in keeping up with present day realities.

I do not intend to talk to-night of the more somber aspects of our time, but I do want to say in passing that I recognize clearly the difficulties facing those who have upon their shoulders the refractory social and political problems of our day. I would like to say that I certainly am not one of those who believe that, if only the world could be handed over to scientists and engineers, all would be well. Our techniques and procedures work well in the physical fields, but the field of human relations I fear presents more subtle problems. It is our duty, not to preach and idly criticize, but as citizens to try with patience, humility and good will to understand how the vast social machine can be made to operate for the good of all and then to do everything in our power to assist in that process.

To-night I wish to talk for a few minutes to the younger generation of engineers in this audience on the brighter side of the picture; to go over with you in a general way something of what has happened in the field of applied science in recent times and enquire as to what we may expect in the future. While science and engineering are, of course, world wide in character, I intend to talk chiefly of what has happened on our continent and in relatively recent times.

Those of us who started our professional careers a few years before the outbreak of the first great war have seen remarkable changes. In 1910 there were perhaps 1500 undergraduate engineering students in the four or five faculties of applied science in Canadian universities, but graduate work in engineering was practically non-existent and it is doubtful if there was a single engineer either in the universities or industry engaged in full time research. To-day there are over 10,000 young men being trained in applied science in a dozen Canadian universities and colleges, and in the research laboratories of the government and industry there are several hundred highly trained young Canadian engineers devoting their lives to fundamental and applied research. In the National Research Council over one-third of our entire scientific research staff are engineers and most of them have post graduate degrees. It may be contended that the situation to-day is unnatural and unusual owing to circumstances brought about by war, and that more students are being trained than can be absorbed on graduation. Such a situation may develop temporarily, although that is by no means certain, but when thinking in terms of a longer period the outlook appears quite bright to me for the following reasons.—*First*, no profession develops as well, either from the standpoint of standard or performance, in a period of personnel scarcity as in a period of competition. *Secondly*, those who graduated at the end of the railroad construction era as I did will recall hearing their elders lament the fact that there would be no further opportunities for young engineers, now that the railways had all been built, as no more survey and construction

[1] See *The Engineering Journal*, August 1947.



Dr. C. J. Mackenzie, Hon. M.E.I.C., is a distinguished Canadian scientist whose writings and addresses merit the careful consideration of all those who would achieve any measure of success in the fields of science and engineering. Whether it be in these or in other professions or pursuits, the successful executive requires, as an indispensable attribute, that of eloquence in speech or writing because he will be called upon many times to make available his accumulated experience and wisdom to those who seek to follow in his path.

Dr. Mackenzie's accomplishments as a speaker are known throughout the length and breadth of Canada. His command of the language, his ready wit and his assured self-possession before audiences large or small have undoubtedly reinforced his scientific attainments in the progression to his present high office as president of the National Research Council. His address to the annual banquet of the Institute's Diamond Jubilee meeting in Toronto undeniably loses something of its flavor by the restrictions of the printed page but the wisdom remains for those who will read carefully and thoughtfully.

parties would be required. Within three decades, however, there were four times as many better trained engineers being graduated and they were finding employment in dozens of profitable fields which previously had not been open to them; in industrial firms, in construction companies, in utilities, government service and investment houses, where, contrary to former opinion or prejudice, it was found that their sound training in the fundamentals of applied science was proving to be of surprising value. There is no reason to think such a trend will not continue with the increase in supply of able and still better trained men.—*Thirdly,* I would like to make a point I will return to again: that former wars have always changed profoundly the progress of applied science and industry, and I suggest the same thing will occur after the greatest of all wars.

Therefore, while I think the present acute scarcity of professional men brought about by war, with its accompanying advantages to young engineers, will not last very long, I do, nevertheless, believe that the long term outlook for young engineers is good and that your relative opportunities (which are all that count) will be excellent.

As engineers we test structures and machines under excessive overloads to find the points of weakness as well as the hidden strengths, and a modern war does that very same thing with our scientific, industrial, and economic structure. Under the stresses of war we perceive weaknesses; weaknesses which were not created by war but were only revealed by war. As a consequence after each modern war the progressive industrial countries change and strengthen the design of their scientific and industrial structure in the light of their war experiences; engineering becomes more scientific and efficient; research is intensified; industry expands; new products appear and greater employment is made possible. This trend is clearly seen to-day.

From 1939-1945 I think we saw for the first time industrial mass production applied to a totalitarian war and we realized also for the first time just how an industrial machine as a whole does work and on what it really depends for its strength. We also realized that everything we require for success in a modern war we require for success in a modern industrial world at peace, although time presses more in the former and defeat and decline is more gradual and less obvious in the latter.

In war we had driven home to us that before equipment could be used there were many steps needed that were absolutely dependent and had to be closely coordinated. We saw that the apparently isolated activities people used to carry on under the names *pure research, development, design, testing, production and efficient use* were terribly interdependent. We realized that *science* is a general term covering everything from research to the assembly line and that with any of the elements missing our national machine can be no more completely effective than a man who depends upon outside laboratories for some of the vital secretions necessary for the functioning of his human machine. In the past war, science came into great prominence and received much public acclaim, but it really did nothing novel; it merely operated for military ends in an emergency, in a hurry, and under a spotlight in the same way it has operated for years under cover and at a more leisurely pace.

The problems of war were seen to be the problems of peaceful industrial competition. One's equipment must be at least equal to that of one's competitors and it must be made in adequate quantity. Perhaps in war the consequences of an unscientific approach may be more disastrous but many once large and powerful industrial companies are now defunct because their product became obsolete and they didn't realize it. It is on the research scientist and development engineer that we must depend for quality and novelty, and any country facing an equal in war would have no chance of survival if it merely waited for its competitor, the enemy, to perfect a weapon and then copied it for production. As the world's industrial potential increases the same thing is becoming more true each day in the field of industrial competition. The natural result is that in every enlightened industrial country today expenditures on scientific and industrial research are many times what they were in 1939 and in those countries which are farseeing there is a determination that as the competition increases and as recessions occur scientific research and examination must be still further strengthened, not weakened.

This is one of the great lessons to be learned from World War II and if Canada follows the course indicated over the years we will need more, not fewer, engineers and scientists but they will have to be more fundamentally trained and a larger and still larger percentage must have graduate training. As an aside—

it is interesting to observe that in the German I. G. Farben company which was outstandingly the most powerful and efficient industrial organization in the world nearly every man on the Board of Directors was a Doctor in Science, Engineering or Economics, and in the operating departments as well, quite apart from the research laboratories, the majority of engineers holding key posts also held Doctorate degrees. That is the inevitable trend, and any country that ignores such signs will move backward, not forward, in the industrial race of the next century.

It has been said and said many times in oratory and sincerity that Canada is borne of the marriage of history and geography. Historically we have ties of sentiment and tradition, literature and institutions with Britain and more remotely with France. Geographically we are a North American nation; in our political traditions, in our culture and in pure science, probably we have been influenced more by Great Britain, but from the standpoint of our engineering profession and practice, geography has undoubtedly played the major role.

On this continent, perhaps more than anywhere else, wars have influenced the form and timing of industrial growth. After the War of Independence the American colonies realized that, if they were to have real independence, they must produce for themselves many of the manufactured necessities previously imported and not depend for existence only on exports of primary products. As a result they established numerous societies for the promotion of the useful arts and to encourage enquiry, industry and experiment and out of that patriotic spirit of industrial independence came a series of practical inventions of great value: Eli Whitney's cotton gin, Fulton's steam boat and many other devices. This was the starting point of American industrial ingenuity, but it was not really application of science. Rather it was improvement in the art of known industrial operations, but it did give a real upward swing to industry.

Again the war of 1812 dislocated trade and stimulated local industry and again after that war renewed foreign competition brought about renewed local efforts which resulted in the birth of the engineering profession on this continent. The formal training of engineers in Europe had been showing the trend in applied science and in America there now appeared an insistent demand for scientific information and knowledge and in 1824 Rensselaer Polytechnic Institute, the first civilian engineering school on this continent, was established. For a quarter of a century this Institute shared with West Point the responsibility of providing engineers trained in the art and science of design and contruction of railways, canals and bridges and a new era was opened up.

When the Civil War broke out there were only four engineering schools but during that conflict when the difficulties were great the Morrill Act was passed (1862) and the land grant colleges specializing in Agriculture and Engineering came into being. By 1870 there were seventeen and by 1880 eighty-five engineering schools turning out an increasing number of engineers to serve a rapidly growing nation. This was the great pioneering age of engineering; railways were thrown across the continent, bridges, canals, industrial plants and cities grew up almost over night. It was a period when daring, enterprise, organizing ability were at a heavy premium. There was competence, even ingenuity, but owing to the rich abundance of resources extreme refinements were not required and for many years American and Canadian engineering practice while robust and resourceful was less scientific than in Europe.

In Canada the engineering profession developed in a similar way though somewhat out of phase. Our first engineering schools were established in the seventies, but at the turn of the century there were only three engineering schools graduating perhaps two hundred students per year. Canadian engineers, like their American cousins of that age, were vigorous, practical and competent men who could locate and construct railways through unbelievably rough country, design and build original and bold structures like the Quebec bridge, pioneer in the fields of hydro electric power developments, in mining and in manufacturing industry; but again the stress was on practical accomplishment, on boldness, on resourcefulness, not so much on scientific refinements and research.

Now we come to the first Great War. That struggle brought home to us in a startling way what only a few enlightened people in America and England had previously realized, namely that Germany had taken the scientific training and techniques of its chemical research laboratories directly into industry and had created a vast monopoly in the field of applied chemistry. When war cut off normal trade it was a profound shock to the people of England and America to learn that they had been depending on Germany for many things essential for both war and peace, and that they were really years behind in fundamental research and in the application of chemical science to industry. After the war America, with characteristic energy, set about correcting that situation and by the time the last war broke out we had all become aware of the strength and number of the great industrial research laboratories in America. Few realize however that this movement which had given America her extraordinary industrial strength took place almost in its entirety in the twenty years following the last war.

In Canada although the same need was recognized and the first steps were taken a similar growth in industrial research facilities did not then take place for several reasons. *First*, up to 1918 there had been little post graduate instruction in our univerities and there were accordingly few qualified research men available. *Again* most industries were not doing any research work in Canada (but were depending on the results of work done in the laboratories of affiliated companies abroad) and *thirdly*, the postwar governments of the day were neither supporting industrial research to any great extent nor convinced of the need for doing so.

On the other hand, constructive forces began to appear in the twenties. The registration in our engineering schools increased steadily, the standards of instructions were raised, and both graduate work and research activities increased greatly. The National Research Council was reorganized and by awarding scholarships and giving grants to research workers assisted in building up the graduate schools of Canada that have done such excellent work during the past quarter century Also by 1929 the Federal Government, having recognized the need, decided to build National Research Laboratories in Ottawa and several other public and private research organizations came into being about the same time.

The result was that by 1939 Canada had a potential for science and research far greater than most people realized. When the imperative demands of war arose, Canada, for the first time moved into the front line of applied scientific research and engineering development and there I suggest, he must remain, not perhaps an Army Group, nor an Army, but certainly an Army Corps and certainly in the front line; not bringing up the rear.

In the war just finished as you all so well know with magnetic mines, asdics, radar, electronics, jet planes, guided missiles, supersonic speeds, superbombers, synthetic rubber and atomic bombs, science, scientific research and scientific engineering came into their own. You were told this afternoon something of what Canada did in this war, and all I wish to emphasize is that scientifically and industrially this country for the first time came into phase with our neighbours. Our industries quickly learned how to make the whole range of intricate war supplies, from synthetic rubber to radar, from large guns to warships, and although we never worked on the bomb itself we are the only country outside the United States that has successfully constructed an atomic energy pile. We now know we can design, construct and operate the most intricate industrial plant capable of working to tolerances and with techniques that were formerly unthinkable.

Now the natural question is what will happen in engineering and applied science during the next few decades as a result of this war, and again I am talking in general terms, not of details.

I think that speaking generally we can say one thing with certainty. Engineering and industry have entered a phase where the gap in techniques, in required scientific knowledge and training between engineers in industry and scientists in laboratories will grow less and less. Just as the war of 1914-18 showed us how Germany had built a new chemical industry on her research laboratories, this war has shown us the same thing in the field of physics as well. In electronics, in precision work, in atomic energy projects, industry can and must in the future do more and more things in industrial plants that formerly could only be done in scientific laboratories and this will open up fields of opportunity comparable to the fields opened up by the electrical and chemical industries.

I am firmly convinced that during the next few decades the engineering profession will tend to recruit more and more highly trained young scientists who have a real interest in applied research and development. I feel that more and more engineers who intend to enter industry directly will take advanced scientific training and I feel that in the future we will be able to point to many corporations in the English speaking world on whose Boards of Directors Doctors of Science will be found.

What will Canada do? Will she participate in this movement? That is up to the younger men, up to the engineers and industrialists of to-day and to-morrow. During the war as I said we marched in the front line although our numbers were not great. Whether we keep line or drop back depends on the effort put into scientific research and the scientific standards of our future engineers. To-day the Dominion Government is spending on research over seven times as much as she did in 1939 and according to our population and economic strength that is a figure which on any standard of comparison is not low. The total amount of research done in our industrial institutions is unfortunately still relatively small but it is increasing and there are most encouraging signs of a growing interest. While in engineering our facilities for graduate work on the Doctorate level are still limited there are to-day a considerable number of scientifically trained engineers doing research work and the numbers are growing daily. Altogether I feel confident about the future of Canadian industry and Canadian engineering, and I prophesy that when the younger men in this audience attend the centennial anniversary of this Institute in 1987 they will be able to look back upon the last forty years as the best years of that century.

THE FIRST CANADIAN TRADE FAIR

May 31 to June 12, 1948

There can be no doubt that Canada is established as a trading nation—in fact with our vast resources and limited domestic consumer demand, we *must* export to maintain our economy.

It behooves every Canadian, therefore, to make his or her contribution to the success of the Canadian International Trade Fair which is to be held at the Canadian National Exhibition Park in Toronto from May 31 to June 12, 1948. It should be expected, of course, that every Canadian firm with exportable products will be on exhibition but in any event the Department of Trade and Commerce should be supplied with all possible names and addresses of foreign trading organizations in order that they may receive official invitations and the full weight of the publicity campaign.

The Department will supply stickers to be used on letterheads and these should be conscientiously used particularly on all mail to foreign countries.

Further information about the fair can be obtained from the Administrator, Canadian International Trade Fair, Exhibition Grounds, Toronto, Canada.

JET ENGINE DEVELOPMENT IN CANADA

P. B. DILWORTH
Manager and Chief Engineer, Gas Turbine Engineering Division,
A. V. Roe, Canada Limited, Toronto, Ont.

A paper presented to the Toronto Branch of The Engineering Institute of Canada on October 23, 1947.

Beginning with an outline of Canadian aviation history up to 1939, the author traces the history and development of jet propulsion, from the early British developments down to the establishment in 1943 of the Winnipeg Cold Test Station, telling how the latter was operated. The parts played in developing a Canadian jet engine by the original Canadian Crown Company, Turbo Research Limited, and by its private-enterprise successor, the " AVRO " Gas Turbine Organization, are told. A description of the A. V. Roe Canada organization, plant, and of the work they are doing on jet engines, is given.

It is with mixed feelings that I have undertaken the task of delivering this talk on Jet Engine Development in Canada. On the one hand, I feel that it is a subject about which there is need of more widespread knowledge from our national standpoint, as to what work Canada has done and is presently doing along these lines. On the other hand, the subject of jet propulsion generally has been given so much attention both in the technical and public press, and by numerous speakers throughout the world, that one hesitates to repeat what has been said or written elsewhere. Unfortunately some repetition cannot be avoided and still paint a reasonably complete picture for the average listener.

Outline of Canadian Aviation History Up To World War II

As you may recall, Canada was the scene of the first heavier-than-air flight made in the British Empire. This flight was made by J. A. D. McCurdy in his " Silver Dart " at Baddeck, N.S., in February, 1909. Since that time, flying has made great strides, and in Canada there has grown up over the years a very sizable aircraft industry in proportion to our population. This industry has managed to survive the extreme expansions and contractions resulting from two great wars, as well as the economic " boom " and depression of the 1930's. I believe it is due to the level-headedness and perseverance of a few public spirited individuals that the Industry has so survived.

It is unfortunate that over the same period of time no parallel aircraft engine industry has evolved. A few small scale attempts have been made to start such an industry, but these have resulted in failure. The reasons for their failure are not difficult to establish. First, there has been insufficient volume of business to make a major venture economically feasible. Secondly, it has apparently been against Government policy until recently to foster such an industry. Finally, I believe there has been a reluctance to establish yet another industry in Canada which would merely manufacture engines to foreign design, whether or not they were entirely suited to Canadian requirements.

Yet to face the prospect of entering such a highly developed and technical field as aircraft engine development appeared too costly to justify in the years preceding World War II. All things considered, it appeared cheaper and reasonably satisfactory for our aircraft industry to rely on importing its power plants from foreign sources. This situation continued and worked fairly satisfactorily until early in the recent War.

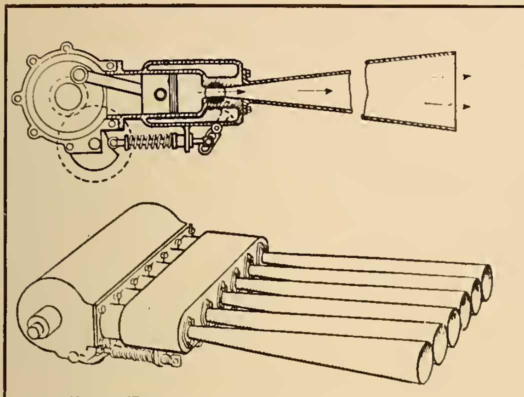
During the early years of the recent War our aircraft industry undertook a tremendous programme of expansion. This was required to meet ever increasing demands for both training and operational types of aircraft—relying however on the United Kingdom and the United States to supply the necessary power plants. Everything worked out reasonably well until the Germans commenced to concentrate bombing on British aircraft factories, and the Japanese attacked Pearl Harbor. In the space of a few months the supply of aircraft engines from both sources became difficult in the extreme and the whole industry was faced with a most critical situation. It is merely history now that we managed to survive the crisis but it served, I believe, as a lesson in the need for independence which has provided the impetus behind subsequent developments.

Though consideration was undoubtedly given during this crisis to setting up a Canadian aircraft engine industry, it was obviously not considered a propitious time for it. Such a decision would have diverted much needed machinery from plants where it could be put to more immediate and effective use. Futhermore, as was pointed out previously, the task of setting up a complete design and development organization for engine development would be difficult and costly under the best of conditions. Such a venture was obviously incapable of bearing fruit in time to be useful to our war effort.

Advent of Jet Propulsion

In 1942 word was received of jet engine developments in the United Kingdom, and this again aroused interest and speculation as to its possibilities for Canada. The stories received about this development

Fig. 1. Whittle's first experimental engine—1937. Photo reprinted from **Proceedings** of Institute of Mechanical Engineers, courtesy British Thomson Houston Company.



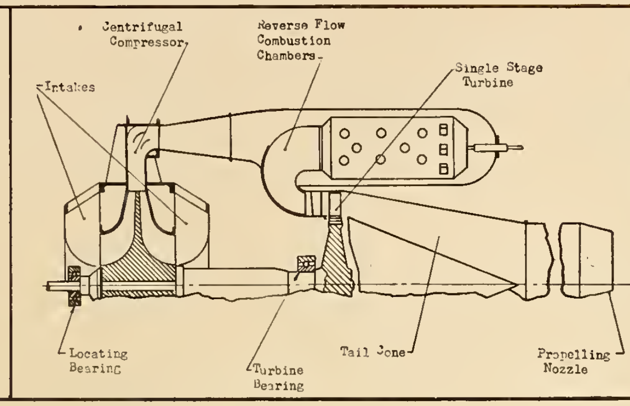


Fig. 2 (left). Lorin jet engine—1908. Photo reprinted from text of "Gas Turbines and Jet Propulsion" by Geoffrey Smith, editor of "Flight".

Fig. 3 (right). **Schematic cross section of Whittle W2 jet engine.**

were coloured considerably by the fantasy arising out of the heavy cloak of secrecy which surrounded this work in Great Britain. We heard that jet engines were only a fraction of the weight of comparable piston engines, and produced prodigious power. They were reputed to be extremely simple to design and develop. It was even stated that they could be manufactured in the average garage machine shop. As it turned out, upon investigation the claims of low weight and prodigious power were substantially true. That they were easy and cheap to design, develop and manufacture was found, however, to be without basis of fact.

The first step taken was to find out more fully what had been accomplished in the United Kingdom. Toward this end a technical mission was sent to England early in 1943, to examine and report on the status of jet engine development in England. Recommendations were also called for as to steps Canada might take to assist the British development to further our common war effort.

This turned out to be no small task, for even at that time most of the British aero-engine firms were heavily committed on jet engine development. Furthermore no comprehensive report could be made without investigating a number of subsidiary industries and research establishments, to determine what problems were involved in the supply of critical materials and components, and in carrying out research allied to this work. The survey and report required five months' intensive work but the findings and recommendations were finally submitted to Ottawa in June, 1943.

History of the Gas Turbine and Jet Propulsion

It is perhaps useful to recall some of the earlier examples in the evolution of jet propulsion. The first recorded scheme making use of the principle of reaction propulsion was the Aeolipile of Hero, an Alexandrian philosopher, about 100 B.C. There followed a number of other proposals down through the following centuries, the most notable being the horseless steam carriage propelled by steam jet, apparently erroneously attributed to Sir Isaac Newton, about 1700 A.D. It is believed that Lorin, a Frenchman, first proposed the propulsion of aircraft by means of a jet reaction engine in 1908.

Mention should also be made of some highlights in the history of the gas turbine. The first recorded proposal for a turbine power plant was made by an Italian, Giovanni Branca, in 1629. This made use of steam as the working fluid. An Englishman, John Barber, took out the first patent on the fundamental gas turbine in 1791. Subsequent work in Germany and Switzerland from 1870 to the present have brought the industrial gas turbine to a fairly high level of development.

British Jet Propulsion Developments

It remained, however, for Frank Whittle when a cadet in the Royal Air Force Engineering College of Cranwell, to propose the application of the gas turbine as an engine for propelling aircraft by what is now commonly called "Jet Propulsion". It was he also who, with a small group of friends, combined the faith, engineering ability and perseverance to reduce his ideas to physical form and demonstrate the practicability of his proposals. Whittle first made known his ideas in 1929, and took out his first patent in 1930. He brought his ideas before the Air Ministry, but they considered his proposals too advanced to warrant undertaking their development. Furthermore there were a number of eminent technical people who labelled his schemes as unpractical, due largely to conclusions drawn from the weight and bulk of commercial gas turbines of that time.

Whittle's first engine consisted of a double-sided centrifugal compressor driven by a single stage turbine. The air from the compressor discharged into a single spirally shaped combustion chamber of circular cross section, in which fuel was burned and from which the hot gasses passed to the turbine, which supplied the necessary power to drive the compressor. The reaction resulting from acceleration of the efflux gases through a final nozzle produced thrust which could be harnessed for propulsive purposes.

Whittle was certainly ambitious and far-sighted, not only in the basic conception of his scheme, but even more so in his very advanced engineering ideas. He set as his goal the achievement of a pressure ratio of 4 to 1, with a single stage centrifugal compressor, when the best that had been achieved at that date was in the neighbourhood of 2½ to 1. His engine was designed to produce the equivalent of about 2400 gas horse power for a weight of approximately 600 lb. This called for a compressor rotor having a maximum diameter of 19 inches to turn at 17,750 rpm., and a power circulating in the shaft between the compressor and turbine of over 3000 horse-power. It meant that each turbine blade would produce about 40 horse-power, and the rim speed of the impeller would be nearly 1500 feet per second.

This engine first ran in April, 1937, and made possible commencement of the tremendous development effort which was to follow, for it secured the blessing and financial backing of the British Government. Second and third engines were built, and finally the Gloster Aircraft Company were commissioned in 1939 to design and build an experimental aircraft in which to try out this first flight engine. This aircraft, a small single engined machine of about 3500 lb. all-up weight, and known as the E28/39, first flew in May, 1941. It easily outflew the Spitfires of its day, and with later engines of the same basic design achieved a speed of over 500 miles per hour. The E28 was followed by the Gloster F9/40 which was the prototype of the now famous Meteor.

Subsequent developments have been both numerous and varied in nature. All the major British aero engine firms came into the picture, and the U.S.A. was given complete information on the developments. In fact a team of experts was flown to the United States, together with one of the early engines and a complete set of plans and drawings, followed later by Whittle himself to act as technical adviser. Since then the design and development of many forms of aircraft gas turbine have been undertaken, and some developed to a quite high level of performance and reliability. There is still much to learn but, as is usual in new projects, progress is exceedingly rapid.

Establishing the Winnipeg Cold Test Station

Recommendations were made in the previously mentioned report on British developments, as to steps which might be taken by Canada to assist the British jet engine developments. Acting upon these, a decision was made to create a winter testing establishment for the purpose of testing jet engines under low temperature conditions such as would be encountered at high altitude or even at sea level under Arctic combat conditions. A survey was made for a suitable site and, upon approval being obtained to go ahead with the project, designs were completed and construction commenced.

Ground was first broken for the foundations of this establishment at Stevenson Field, Winnipeg, on September 15, 1943. The buildings were occupied and the first engine run on January 4, 1944, less than four months from the time construction started. Incidentally this first engine and a quantity of vital instruments and test equipment were flown from the United Kingdom to Edmonton via Dakar by the United States Army-Air Transport Command.

During the time that the buildings were being erected and test and shop equipment were being procured, a group of engineers and fitters was recruited from various places in Canada and sent to the United Kingdom for several months' training on the testing and overhaul of jet engines. These men were brought back to Winnipeg during December, 1943, and formed the backbone of trained staff which operated this station during that and subsequent winters.

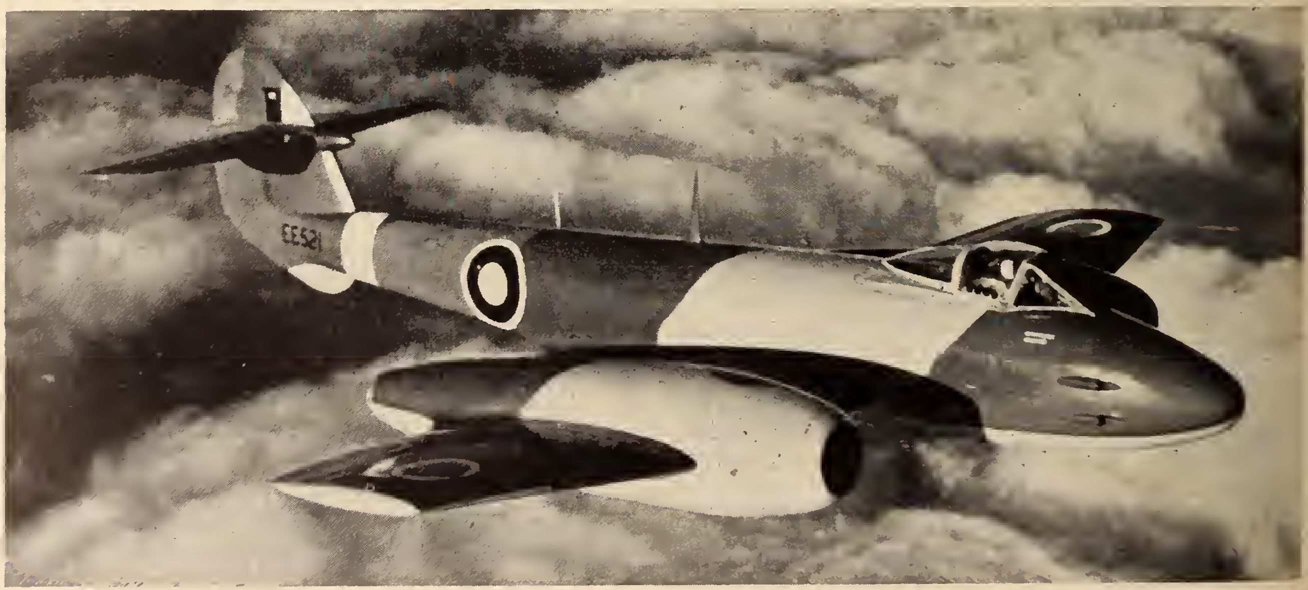
The training of personnel, construction of the establishment, and test operations through the winter 1943-44 were carried out under the National Research Council. I feel bound to state that the wholehearted support given by the National Research Council and the Department of Munitions and Supply set a standard which I have not seen excelled. Without this support the success of the project would certainly have been impossible.

Operation of the Winnipeg Cold Test Station

Before continuing the account of subsequent developments, it may be as well to devote a few words to some points of technical interest in the operation of the Winnipeg establishment. Thus far the reasons for cold testing jet engines have only been touched on very briefly, and some discussion of the technical considerations may be in order.

Four types of problem were anticipated in the operation of jet engines under cold conditions. These were respectively: engine performance, starting and general mechanical difficulties, and icing. It was an-

Fig. 4. Gloster Meteor IV twin jet fighter. Printed by permission of A. V. Roe Canada Limited, through courtesy of Gloster Aircraft Co. Ltd.



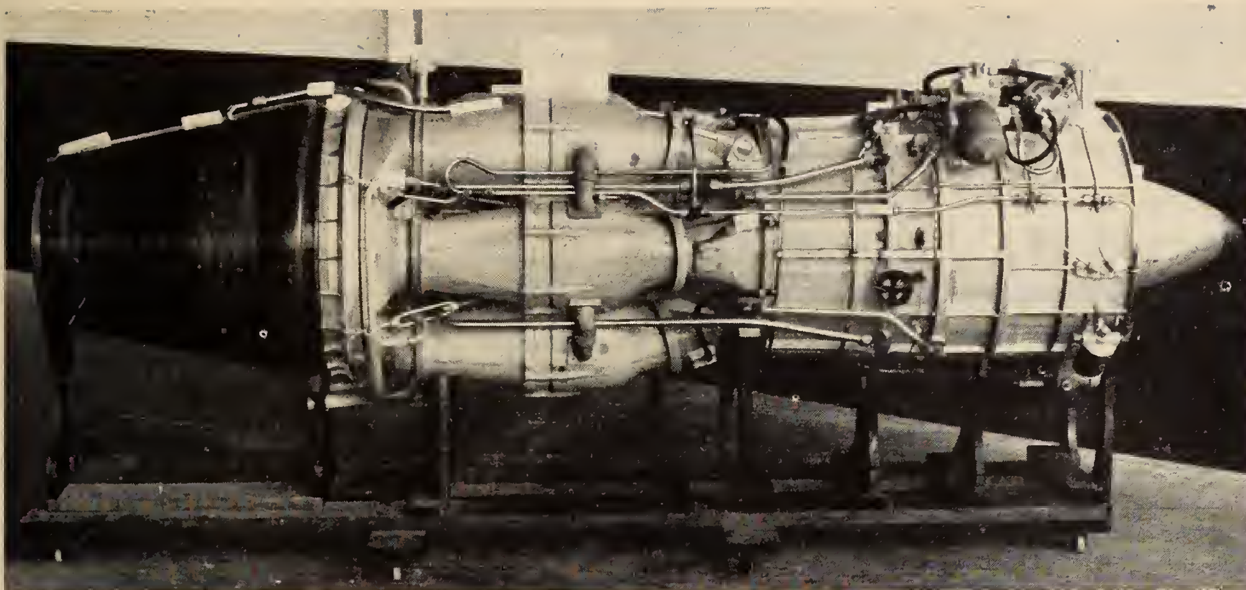


Fig. 5. Wooden model AVRO Chinook. Axial jet engine—Malton. Courtesy A. V. Roe Company.

ticipated that aerodynamic limitations would be met in the operation of both centrifugal and axial compressors at low temperatures. This is because lowering of the air temperatures also lowers the sonic velocity, and thus hastens the onset of compressibility troubles. It was necessary to determine by actual test how serious these difficulties might be.

At the same time it was essential to ensure that these engines would start successfully under cold conditions, and that they would function with mechanical reliability. Icing of both axial and centrifugal compressors was also recognized as a potential major hazard. The problem of developing a technique for simulating flight icing conditions on the ground was, however, considered too great an undertaking as a wartime project. For this reason icing tests were eliminated from the test programme.

Due to the vast quantities of air consumed by even the smallest British jet engine (about 30,000 cfm.), it was impossible to provide adequate equipment for artificially refrigerating air soon enough to be of use on wartime development. Since Canada had an abundance of cold air supplied by nature in winter, this appeared to provide a logical and quick solution to the problem of cold testing. With the enthusiastic support of the British Government and various British engine firms, the Cold Test Station project was undertaken. This establishment was operated through the three winters of 1943-44, 1945 and 1946, during which a number of different engine types were tested, and much useful information was obtained on the above problems, with the exception of icing.

Creation of the Canadian Crown Company—Turbo Research Limited

The second phase of Canadian developments began in August, 1944, when the Government set up a crown company known as Turbo Research Limited, with headquarters at Leaside, a suburb of Toronto. This company was to be roughly the equivalent of the British firm of Power Jets Limited—Air Commodore Whittle's old firm. Turbo Research Limited was charged with carrying out in Canada all research and development work on gas turbine engines. Consistent with this policy the Winnipeg Cold Test Station of the National Research Council was turned over for operation under Turbo Research and it was so operated until May, 1946, when it reverted to the control of the National Research Council.

The first activity of this Company was to recruit, train and organize an engineering staff. Though it was considered a long term project, and not intended as part of the war effort except for the operation of the Winnipeg Cold Test Station, it was nevertheless found possible gradually to recruit personnel. Engineers and draughtsmen were gradually hired. A number were sent for training in the United Kingdom at Power Jets Limited, and at some of the British private firms. Also the Royal Canadian Air Force sent a number of officers and non-commissioned officers to take courses of instruction at Power Jets and elsewhere. Many of these later took up employment with Turbo Research upon their release from service.

During the time staff were being hired and trained and the engineering department organized, the Government altered its policy on the manner of carrying out this work. What the reasons were is not known. Undoubtedly, however, a revision of British policy early in 1945 had some bearing on the matter. In any case the British early in 1945 turned over all engine development work to private industry. The Power Jets organization was converted into a research establishment, its name being changed subsequently to the National Gas Turbine Establishment.

Transfer of Engine Development to Private Industry

The Canadian Government followed a similar course, and decided early in 1946 to discontinue the operations of Turbo Research Limited. A. V. Roe Canada Limited took over the task of designing, manufacturing and developing jet engines. The National Research Council undertook to carry on the necessary allied fundamental research work.

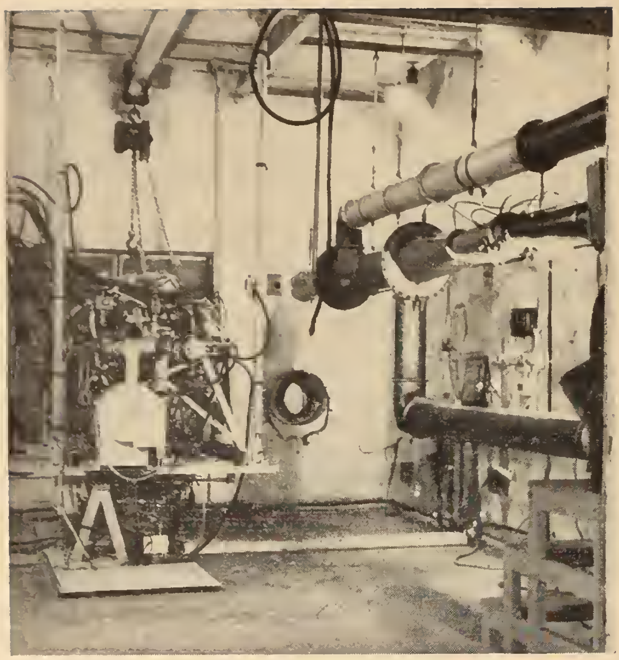


Fig. 6. View of engine test cell, N.R.C. Cold Test Station. Photo courtesy National Research Council of Canada.

The life of Turbo Research Limited was short, having lasted from August 1944 to April 1946. It nevertheless provided the vital working base for the gas turbine engineering organization which now exists at Malton. During that eighteen month period the staff grew from one man, the former chief engineer, to about ninety. Of these, some twenty-five were given training in the United Kingdom on various phases of engine design and development.

Furthermore, several basic engine designs were laid down, one of which was completed, though later discarded. A second was in the fairly advanced project stage when the work was transferred to AVRO. The design of this engine, known as the CHINOOK, was completed by AVRO during the remainder of 1946 and early 1947. Its construction is now well underway, and it is expected to have it running early in 1948. The design of a second engine is also in an advanced stage.

Outline of A. V. Roe Canada Gas Turbine Organization

The AVRO Gas Turbine Organization is presently made up of two major divisions. The manufacturing division comprises all shop, tool design, planning personnel and manufacturing equipment. The engineering division comprises all design, experimental, laboratory, inspection and test personnel. There are presently some two hundred and fifty employees in the manufacturing division, and approximately two hundred in the engineering division, including some forty graduate engineers, sixty draughtsmen, and a sizable number of laboratory technicians and others.

When it is realized that this staff has expanded from a total of about one hundred persons since May, 1946, one can imagine that there has been some suffering from growing pains. It is expected that this number will approximately double over the period of the next two or three years. This will undoubtedly cause further distress before the organization becomes reasonably stabilized.

The available physical facilities fall into three main groups. First, there is the experimental shop comprising a major portion of the former Victory Aircraft Company machine shop, which was engaged in turning out Lancaster bomber components through the war.

Secondly, there are the Malton laboratory facilities which have been designed, built and equipped since we started at Malton in May, 1946. These comprise a mechanical test laboratory for testing of engine components such as bearings, seals, gear boxes, engine blading, and the like; and a fuel system component test laboratory for testing and developing engine fuel system components such as fuel pumps, burner jets, flow control units and so forth. There is also an aerodynamic laboratory containing a small wind tunnel, and an electrolytic analogy tank for experimental aerodynamic work aimed at improving the design of turbines and compressors and at reducing losses in various gas passages in order to obtain higher efficiencies; an instrument laboratory for the development of special instruments and equipment necessary in the testing of engines and their components; and finally an engine test laboratory, now under construction, for the purpose of testing entire jet engines.

The third major group of physical plant is located at Nobel near Parry Sound. Here the former Defence Industries Limited explosives plant power house and machine shop have been taken over. These are used for the testing and development of compressors, turbines and combustion chambers, and also for performing miscellaneous aerodynamic tests on aerofoil cascades, diffuser passages, etc., in connection with compressor and turbine design. The location of this establishment is, of course, a disadvantage from the standpoint of liaison and administration. Yet the basic power plant equipment consisting of a 6000 hp. steam turbine for compressor testing, and five large reciprocating air compressors capable of providing a substantial supply of high pressure air for combustion and aerodynamic tests, is the equal of that available to most firms in the United Kingdom and the U.S.A. today.

Future Developments

Upon an occasion such as this, I believe it is customary to jeopardize one's reputation by hazarding a prophesy on future developments. In this regard I intend to be rather guarded in my predictions.

Suffice it to say that, in my opinion, the aircraft gas turbine is as yet in its relative infancy; that in years to come it will largely replace all existing aircraft power plants of over approximately 1000 hp., either in its straight jet form or its propeller turbine or other variants. The rocket and ram jet, or thermal duct engines, will undoubtedly find an important place as well, but mainly I think as auxiliary power plants, or as primary engines in very high speed short range military aircraft.

I believe extensive use will also be made of the gas turbine in marine, locomotive and stationary work, but I predict for it a much stronger competition from the steam plant in these applications, than from the large power aircraft piston engine in the field of aviation.

PROFESSIONAL ADVANCEMENT IN CANADA

DR. C. R. YOUNG, M.E.I.C.
Dean of the Faculty of Applied Science and Engineering, University of Toronto.

An address delivered on October 24, 1947, in Montreal, at the annual meeting of the Engineers' Council for Professional Development.

Dean Young believes insufficient weight is given to general education by licensing associations for engineers. Counselling committees set up by The Engineering Institute of Canada, as well as the Canadian Committee for Student Guidance in Science and Engineering, have progressed notably in the selection of engineering students since 1939. Extension of guidance to graduates is planned. Outstanding examples are cited of engineers who have attained prominence in public life. Their success is attributed to their dealing with persons rather than with things. Professional schools of engineering, and licensing bodies as well, he claims, should elevate their standards of admission, while members of the profession should preach sound professionalism at every opportunity.

Prior to confederation of the Canadian provinces, in 1867, there was so little employment for engineers in Canada that organized attempts to promote the advancement of the engineering profession made but scant headway. The first sustained effort in this direction came with the establishment of the Canadian Society of Civil Engineers, in 1887. The Engineering Institute of Canada, with its broader interests and wider scope, has since 1918 carried on and vastly extended the activities of the parent society from which it sprang.

Early in the nineties sustained agitation developed for the constitution of the profession in Canada as a closed corporation, analogous to those of law and medicine. In 1892, Alan Macdougall, one of the far-seeing and resolute engineers who had taken part in the establishment of the Canadian Society of Civil Engineers, presented to the Society a notable paper on "The Professional Status". It was a classic. In it were challengly set out most of the concepts and arguments that still engage the thought of those who concern themselves with the matter at all.

The discussion bore fruit. Drafts of acts for the provincial incorporation of engineers were prepared. According to the terms of the British North America Act, which constitutes whatever of a written constitution Canada possesses, legislation controlling engineering practice is a matter for the provinces rather than for the Dominion. Proceeding in conformity with this, the members of the Canadian Society of Civil Engineers in Manitoba succeeded in obtaining legal recognition of engineering as a profession in that province, by the enactment of the Manitoba Civil Engineers Act of 1896. Here, as elsewhere in Canada at that time, "civil engineering" was deemed to comprehend all engineering that was not military. Quebec followed suit in 1898.

Proving difficult of operation, these acts were superseded in 1920 by improved acts administered respectively by the Association of Professional Engineers and the Corporation of Professional Engineers. In comparatively rapid succession all the remaining provinces, except Prince Edward Island, which by reason of its size has few engineers, have enacted restrictive legislation.

While marked benefits to the public, as well as to engineers themselves, have been derived from the licensing movement, one undesirable consequence has followed in its train. Far too many young men have come to assume that the only thing lying between them and full professional stature is the obtaining of the legal right to practise. Nothing could be more illusory. There is no assurance whatever that one so equipped will necessarily be accepted by a discerning and critical public as a person fully entitled to the esteem and deference that by common consent are accorded the members of the older and so-called learned professions. One illiterate or boorish licenceholder may offset in the public mind the merits of a score of others about whom there can be no question. The whole profession is compromised by the unacceptable few.

Not enough weight has been given to general education by either the professional schools of engineering or the licensing associations. Two screens in tandem should be placed in the educational and training stream. The first would function as a selective device to ensure, in so far as may be possible, that those who enter the professional schools have those humanistic and cultural interests and capacities that must be inherent in one who hopes to be accepted as a member of a true profession. The second should be introduced by the licensing bodies in scanning applications for registration, as a check on the effectiveness of the first as an instrument of selection of personnel for educational and professional training, and as a corrective if it has failed.

Faculties and colleges of engineering ought to revise sharply upward their general educational requirements for admission, so that the twenty-five per cent or so of young men who should remain in technical institutes or secondary vocational schools are kept there, and so they are not permitted to impede the programmes of the professional schools. Far better work could be done in the latter, and the quality of their output made the more impressive, if they were not required under circumstances presently existing in Canada to superimpose on true collegiate work the added task of dealing with the area of education that lies between the secondary schools and the universities. Those whose talents and interests definitely belong to this zone are for the most part unpromising aspirants for full professional qualification.

On their part, the licensing bodies should place increasing emphasis on the general educational attainments of those who seek registration. There are still substantial numbers of applicants who base their claims almost wholly on technical knowledge and competency, and but little on acquaintance with those things that characterize a broadly educated man. As a result of undue emphasis on the importance of excellence in mathematics and science, some men of circumscribed outlook have unfortunately slipped through the universities with small evidence of ability to express themselves clearly or correctly in their own language. The proposed second barrier against illiteracy in professional circles could be introduced by the licensing associations through requiring in respect of the graduates of the professional schools a minimum standing in non-technical subjects and through a corresponding test of those who seek registration through examination.

It is unfortunate that some young men look to the professional associations to do for them what only they can do for themselves. Attainment of that degree of public regard that in effect accords to the one that prompts it a vital place in the community wherein he labours, derives from the personal merits of the man himself and not from the bulk or the forcefulness of any organization to which he belongs. One cannot be securely legislated into high places. Professional organizations have a value that is largely limited by technological and economic considerations. They cannot give that quality of understanding, that sympathetic man-to-man relationship that determines ultimate acceptability.

Efforts of the Canadian Professional Organizations

It would be unfair to say that engineering organizations in Canada have been unaware of this fundamental principle. They are doing much to raise the quality of the profession by directing into it young men of the highest personal promise, and correspondingly by exclusion of those that are unsuitable. They no longer rest their labours on the promotion of technical knowledge and competency. The development of the engineer as a person bulks large in the policies of all of them. No longer is it merely a matter of producing annually an output of human problem-solving machines in quantity gauged to the supposed demands of industry.

Such selection of engineering students as is possible through counselling and guidance programmes has progressed notably in the past few years. Through its Committee on the Training and Welfare of the Young Engineer, established in 1939, The Engineering Institute of Canada has set up counselling committees in its various branches across the country. Growing out of this the Canadian Committee for Student Guidance in Science and Engineering, composed of representatives from the Canadian Institute of Mining and Metallurgy and the Chemical Institute of Canada, as well as from The Engineering Institute of Canada, was set up and has expanded the original effort.

These Committees have served a double purpose. They have drawn to the attention of young men who were contemplating engineering careers the requisites for success in such callings. They have diverted into other fields those who gave little promise of success in the engineering field. At the same time, prospective students have been shown, and the news travels fast, that many senior members of the profession are interested in the personal fortunes of those who seek entrance to it. Identification of eminent practitioners with the interests of oncoming youth is an asset on both sides.

Extension of guidance service to young engineers subsequent to graduation is being planned. Formal machinery providing sponsorship of each graduate by an experienced engineer does not appeal particularly to young Canadians, but they do appreciate and welcome the informal fraternization and encouragement that comes naturally when senior engineers mix in meetings and gatherings with those who have most of their careers before them.

Although no formal steps have as yet been taken to set up a system of accrediting to professional schools of engineering in Canada, there is little doubt that this will be undertaken in the not too distant future. A suitable mechanism would appear to be through the Committee on Applied Science and Engineering Education of the National Conference of Canadian Universities. This Committee, organized in May, 1946, had an excellent first meeting on the occasion of the annual Conference in May, 1947. It is composed of one representative from each of the member universities and colleges of the Conference offering engineering instruction at the university level. The desirability of making an early study of accrediting in Canada will be drawn to the attention of this Committee as soon as its 1947-48 organization is completed.

No organized measures for direct promotion of professional recognition in Canada have been devised. Individual members of the profession have, however, come into high and well-deserved prominence, not only through wartime activities, but in peaceful pursuits as well. One might cite the outstanding record of the Right Honourable C. D. Howe, Minister of Reconstruction and Supply, born an American, who before entering political life headed a highly successful firm of consulting engineers. General A. G. L. McNaughton, now President of the Atomic Energy Control Board of Canada and Chairman of the Canadian Delegation to the United Nations Atomic Commission, bears a responsibility that not only confers an honour on the profession in which he was trained, but places Canada immeasurably in his debt. Dr. C. J. Mackenzie, President of the National Research Council, has provided an illustration of the power of an able and resourceful engineer in directing the programmes of a great scientific agency. The bench is honoured by men who were trained as engineers and do not regret that approach. One such is the Honourable Mr. Justice R. E. Laidlaw, of the Appellate Division of the Supreme Court of Ontario. Diplomacy has made its bid too, for the services of those with technological training. Mr. C. Fraser Elliott, an able Deputy Minister of the Department of National Revenue, has now become the Canadian Ambassador to Chile.

It may appear strange that those members of the engineering profession who most frequently come into public notice are those who have moved over into other fields as a result of the capacity that they displayed while ranked amongst the engineers. Doubtless this is due to the fact that in public capacities they deal much more frequently with persons than they do with things, and become more widely known for it. It might almost seem that the most effective approach to national eminence on the part of the engineer is to conduct a flank movement through territory traditionally occupied by members of other professions and callings.

Resistance To Professional Advancement

Long-seated resistances to the new and broader concept of engineering as a learned profession, with all that the term connotes, still confront those who labour for its realization. One can scarcely wonder at their existence when it is remembered that in English-speaking countries, up to a century and a quarter ago men prepared themselves for engineering tasks and responsibilities in the same manner as they had from the dawn of history. They learned by trial and error, by observation, practice, and apprenticeship.

The English millwrights, — all honour to their sturdy enterprise and resourcefulness,—were but uneducated workmen with little or no thought of a higher status. James Brindley, the man who developed the great inland waterways system of Britain, could scarcely read or write, and was content to receive throughout his amazing career no more than the wages of a skilled mechanic. George Stephenson and Thomas Telford began similarly, but, although achieving more exalted heights of professional prestige, they and those that followed them during many succeeding years in Britain regarded apprenticeship as the only satisfactory means by which one could become an engineer.

The things worth knowing being therefore conceived of those that could only be acquired by operations in the shop and field, it is not strange that little thought was given to the more polite forms of learning, such as are prized by men who excel in other professions or in public life. The concept of engineering as no more than a superior trade persisted, and remnants of it still remain to plague those that strive for something more.

Ignorance of what men in other walks of life think or do has bred narrow intolerance in many of those who cling to the old attitudes. Knowing little of others who live and work in spheres very different from their own, they are disposed to belittle and suspect them as the south Englanders did of the men of the north in the days before the improvement of transportation made contacts easy and frequent.

Even in these days which we euphemistically term enlightened, there are many young men seeking entry to the universities that think only of the mastery of an intricate trade, the acquisition of a few scientific or technical tricks that will make them superior to their less practical fellows, and give them an easy and secure livelihood unattended by any obligation to pull their own weight in the social, humanistic and political efforts of their time.

Some Suggested Measures

While unstimulated awareness of the superior advantages of the well-educated man, as contrasted with one of narrow outlook, may bring eventual but slow remedy, educational institutions and professional organizations cannot allow the matter to rest there. Positive and definite action needs to be taken.

On their part the professional schools of engineering should revise upward their standards of admission, at least in so far as general educational subjects are concerned. For example, a bare pass or credit in English ought not to be accepted. A man who is so deficient in the use of this mother tongue as to be wrong as often as he is right in the use or appreciation of the spoken or written word is a sorry prospect for profession eminence. He may be a clever deviser of mechanisms, and an accurate predictor of what they will do, but completely ineffective as a member of a society that depends for its progress on the co-operation of educated men dealing with situations on which their personal specialities have little bearing.

The professional associations, or licensing bodies, have likewise an opportunity for significant and constructive action. Let them scrutinize with particular care the general educational qualifications of every applicant for admission, whether he comes by way of a university or directly from the shop, office, or field. Examinations for those who are not university graduates might very appropriately include a paper in English beyond the level of the last grade in high school.

Seasoned members of the profession should lose no opportunity of preaching sound professionalism in season and out. Its leaders should be invited to pass on to students the results of their experience and observation in functioning as responsible citizens, and not merely as accomplished technologists. Young men in college will accept with avidity advice of this type " from outside " while they will listen incredulously to a member of the regular staff who tells them the same thing,—and perhaps rather better.

The fullest possible use should be made of biographical material in attempting to press home concepts of desirable professional attitudes and conduct. After all, every one of us is much more interested in men and what they do than in philosophical or ethical doctrines.

PROGRESS OF THE PROPELLER-GAS TURBINE

It is reported from Great Britain that two more propeller gas turbine aircraft power plants are in the airborne testing stage, the tests in both cases being carried out with the engine installed in the nose of a Lancaster bomber.

The Rolls-Royce *Dart* has a two-stage centrifugal compressor and has been evolved from initial testing of the early *Welland* and *Derwent II* jet engines modified to take reduction gearing and propeller. The Armstrong-Siddeley *Mamba* uses an axial flow compressor which permits a design with an overall diameter of only 27 inches to give only about 30 percent of the frontal area of a comparable piston engine. Both engines deliver about 1,100 hp. for take-off and, characteristically, have a very low all-up weight in comparison with piston engines of equivalent performance.

When it is noted that gas turbines in this power range operate at speeds of the order of 15,000 revolutions per minute and that most efficient propeller speeds are closer to 1,500 rpm., the magnitude of the reduction gear problem becomes apparent. In piston engines propeller speed is about one half engine speed and even under this condition reduction gearing has presented a problem in weight and space requirements.

INDUSTRIAL PROCESS VENTILATION

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This paper deals with industrial ventilation problems created by processes generating dusts, fumes, and vapours, rather than with problems arising from the needs of humans for suitable temperatures and humidities in workrooms. Its aim is to guide the plant engineer in writing intelligent specifications.

The various types of process ventilation, with their objectives, are enumerated and each described briefly, using illustrations. The advantages and disadvantages of local and general ventilation are discussed. Examples of methods of reinforcing ventilation rates are given. Economies possible through "successive ventilation" are pointed out. Heat savings possible through the short circuiting of air are shown. The paper concludes with a check list of practical considerations for guidance of the plant engineer in reviewing the design of a ventilation system.

The subject of this paper requires definition. "Industrial process ventilation" is not a widely used phrase, and the reasons for its selection will serve here as an introduction.

"Industrial air conditioning" is the preferred expression for complete control of temperature, humidity, air motion, thermal radiation, and air cleanliness; it implies such control for both the health and comfort of workers and the quality and rate of production. At the present time this is more likely to be the concept of the layman than that of the heating and ventilating engineer, paradoxical as it may seem.

At the time the American Society of Heating and Ventilating Engineers was organized (1895), the term "air conditioning" was not in common use. If such a society were inaugurated today, I believe the potential membership could be sold on the name "American Society of Air Conditioning Engineers." Nevertheless, air conditioning has acquired a strong association with the process of cooling or refrigerating the atmosphere of theatres, restaurants, clubs, offices, and homes during hot weather. In fact, this class of air control problem was largely responsible for publicizing and popularizing "air conditioning." Only by gradual transition has the term demonstrated its convenience for specifying the complete year-round treatment of indoor atmospheres.

Process or product air conditioning has implied for some years the regulation of temperatures and humidities according to the thermal and hygroscopic requirements of such products as textiles, paper. foodstuffs, pharmaceuticals, photographic film, plastics, precision instruments, and optical goods. Recent demands of increasing product quality have focussed attention on the additional control of corrosive gases, damaging dusts, and contaminating micro-organisms, but careful examination of the chapter on "Industrial Air Conditioning" in the 1947 *Guide* of the American Society of Heating and Ventilating Engineers will indicate the predominance of psychrometric approach to industrial process air conditioning. The Society is now in the course of modernizing the concept of this chapter of the *Guide*.

"Industrial Ventilation" might have been the title assigned to this paper, except for the fact that its implied scope still would be too broad. It is not synonymous with industrial air conditioning, inasmuch as it suggests special interest in the movement, displacement, distribution, or transport of air within industrial buildings, even though the air may not be specially treated to alter its physical or chemical quality. This is somewhat a personal interpretation, since a few engineers have insisted that "ventilation" is a more inclusive term than "air conditioning." Yet, the majority rule at the moment does seem to be that ventilation is only one phase of comprehensive air conditioning.

Attention is given here only to the problems of ventilation in industry that are created by processes generating dusts, fumes, mists, vapours, or gases, and not to those problems arising from the activities or needs of human beings. Thus, we do not discuss the phases of air movement or exchange related to thermal comfort, oxygen deficiency in confined quarters, air stuffiness produced by crowded departments of sedentary workers, or the special problems of ventilation for cafeterias, washrooms, toilet facilities, lockers, showers, and dressing rooms.

"Industrial Process Ventilation" has been selected to designate the special branch of industrial air conditioning dealing with the mechanical and chemical control of air contaminants traceable to industrial processes. It includes every kind of ventilating method from general or space ventilation to highly specialized local exhaust systems with effective air cleaning devices.

The present paper is not an attempt to digest the essential data required for the successful design of process ventilation. It aims instead to suggest new viewpoints and considerations whereby the plant engineer may intelligently specify the kind of ventilation he expects the consulting or contracting engineer to install in his plant. In the writer's estimation, the users of process ventilation designed by others are entitled to know that a good many ventilating engineers are not at all sure of their designs, and that common sense applied at significant points by the customer may avoid the purchase of monstrosities conceived according to the most scientifically sound aerodynamic formulas for the behaviour of air in motion.

Objectives of Process Ventilation

For hundreds of years industry's operations have caused the air of workrooms to accumulate annoying and even harmful substances. In some cases the structures were so poorly built that natural wind and thermal forces kept the concentrations of dangerous airborne materials low enough so that acute illnesses did not develop. Furthermore, the rate of generation of dusts, smokes, or gases was related to the output of human beings and not to the mass production abilities of complex machinery. At the same time, the employee was expected to assume the risks of potentially hazardous operations, and employers accordingly did not feel obligated to spend large sums of money to reduce these risks.

Possibly the most important of all reasons for the delay in special concern for the airborne wastes from industrial activities was the nearly universal ignorance of the real nature of industrial respiratory diseases. Even such a well-known occupational disease as lead poisoning was thought, until quite recently, to be more likely the result of ingestion, or carrying into the mouth on hands and foods, than the result of inhaling the invisible particles of lead dust or fume. Often the early writings of philosophers and physicians suggested the airborne nature of common occupational illnesses, but workers and employers alike steadfastly insisted during each generation upon learning some of the important lessons the hard way.

Accurate knowledge of airborne industrial diseases is really a twentieth century development. The famous silicosis disaster of Gaulley Bridge in West Virginia is less than two decades old. The automobile body industry learned the technics of controlling new exposures to lead dust a little more than one decade ago. There are at this moment unsolved respiratory afflictions because of the technical difficulties in tracking down extremely minute quantities of microscopic and submicroscopic air contaminants.

The most important object of industrial process ventilation, therefore, is to prevent the occurrence of occupational illnesses or deaths. Whether personal comfort is achieved at the same time depends strictly upon the chemical substance involved, because there is no correlation between the toxic, irritant, inebriating, or odour consequences of inhaling industrial dusts, fumes, vapours, or gases. Occasionally the odour of a volatile solvent will serve as a warning of the approach of dangerous quantities in the respired air, but just as often a vapour or gas will offer no sensation at dangerous levels. Microscopic dusts and metallic fumes likewise may give no evidence of their presence in the breathing zone even when the concentrations are excessive. We must conclude that human beings have not been able in the past to keep out of trouble with microscopic airborne enemies, and there appears to be no hope of depending upon our senses to give us the necessary protection in the future.

The professional specialty of industrial or occupational hygiene has grown rapidly in the last few decades, largely as a result of the concentrated problems brought about by high-speed production methods. It is this group to which the ventilating engineer must look for guidance in judging the seriousness of industrial air contamination. The industrial hygiene chemist has evolved highly sensitive laboratory and field technics for detecting and identifying harmful air contaminants, and rarely will the ventilating engineer be in a position to utilize personally even the simpler of these methods in his work of collecting facts upon which to base the design of process ventilation.

Numerous industrial processes give rise to annoying, irritating, offensive, or nauseating air contaminants that must be controlled even though they would not be classed as occupational poisons. In such cases the responses of large groups of workers are better indices of the magnitude of the problem than the scientific findings of toxicological laboratories working with small animals. Unfortunately very few investigators or designers have publicized their findings or experiences in the control of the nuisance type of air contaminants. Until more of this kind of information is distributed, each ventilating engineer must work out his problems on the basis of experience or according to the time-honoured services of trial and error.

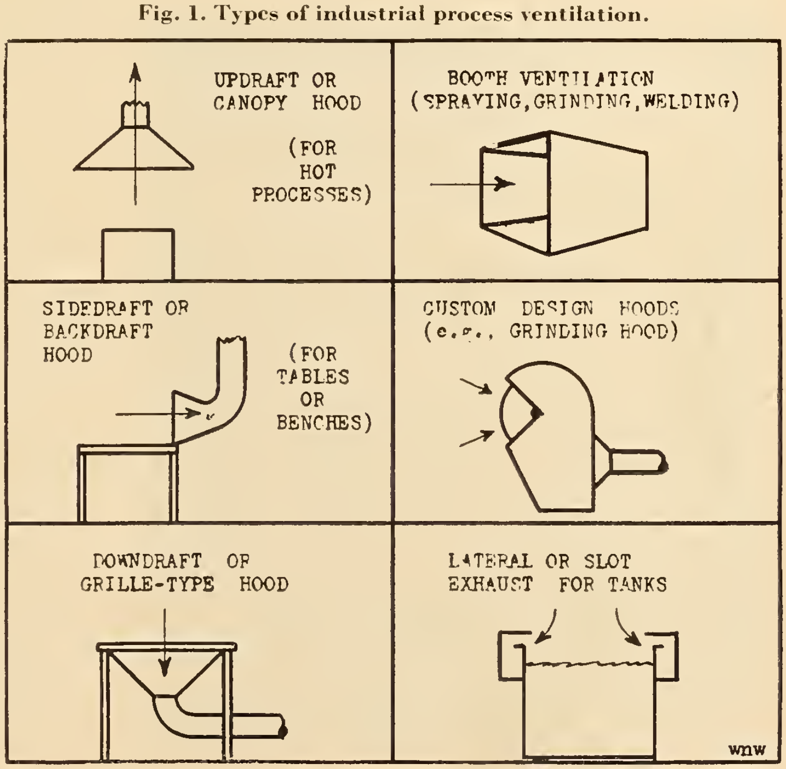
The prevention of occupational disease is by no means the only important objective of process ventilation. Fire prevention is one of the jobs of the ventilating engineer, principally in the use or handling of flammable gases or vapours, and combustible powders or dusts. On occasion the requirements of fire prevention are more stringent than those of disease prevention, but by far the greater number of cases demonstrates the fact that human beings cannot safely breathe quantities of many air contaminants that are nevertheless safe from the standpoint of fire or explosion.

Sometimes the purpose of industrial process ventilation will be the protection of machinery, equipment, or buildings from the action of corrosive air contaminants. It may be used to keep dust from getting into the delicate interiors of automatic devices or electronic apparatus. There may be the danger of troublesome contamination of electroplating solutions if certain dusts or mists are not captured at their source of production. Extreme precision or rigid quality specifications may dictate the use of effective process ventilation as a prerequisite to successful compliance with the customer's demands. The varieties of technological problems that may confront the ventilating engineer seem endless, now that industry has recognized the value of atmosphere control.

Varieties of Process Ventilation

An important lesson learned sooner or later is that no one method of ventilating industrial processes has a monopoly in good results. For example, specialized local exhaust hoods are not the answer to all of industry's microscopic airborne wastes. There may be more arguments in favour of exhausting contaminants

Fig. 1. Types of industrial process ventilation.



at their point of production than for other methods of preserving the quality of air breathed by workers, but there are also plenty of examples of local exhaust systems that grow to such enthusiastic proportions that they become entirely prohibitive to use, either from the standpoint of valuable productive time lost, or due to the high cost of maintenance.

Accordingly, it is wise for the ventilating engineer to review several methods of preventing excessive air contamination so that each method may compete fairly within his mind for the job at hand. It is a temptation to specify or design along the lines for which data are immediately available, but an imaginative, versatile ventilating engineer is worth a dozen handbook artists at this stage of the profession, because exceedingly little data has been offered on the subject by any contemporary handbook.

The classification of methods of process ventilation given below cannot be offered as the consensus of a substantial group of specialists in the field. At the present time nearly every writer or speaker on the subject has a favourite classification, and it must be admitted that the one given here is merely one of several possible arrangements.

A. Natural general ventilation

1. anemotive ventilation: produced by horizontal wind forces or by the suction created over roof vents or openings subjected to substantial wind velocity.
2. thermal or "gravity" ventilation: produced by convection currents or by indoor-outdoor temperature differences.

B. Mechanical general ventilation (non-directional)

1. supply, pressure, or plenum ventilation: air supplied to a space to create a slight pressure that forces air outward through any available opening in the absence of wind pressure of greater magnitude.
2. exhaust, suction, or vacuum ventilation: air removed from a space to create a slight reduction in pressure that causes outdoor air to force its way in through any available opening.

C. Local dilution ventilation (directional)

1. dilution by supply: clean air blown across the work area toward the source of contamination to diffuse the material into the large air reservoir of the room.
2. dilution by exhaust: clean air drawn or exhausted across the work area toward the source of contamination, but no exhaust hood or process enclosure provided.

D. Ventilated process enclosures

1. complete enclosure, worker inside: sufficient air exhausted to prevent escape of contaminant to surrounding areas, maintain visibility, or prevent accumulation of an explosive or flammable concentration; worker required to wear air-supply respirator.
2. complete enclosure, worker outside: remote control or automatic process; ventilation objectives similar to those for item D-1.
3. partial enclosure, worker inside: ventilation rate selected to prevent escape of contaminant through openings to rest of workroom; worker usually provided with some form of respiratory protection, depending upon the properties of the contaminant.
4. partial enclosure, worker outside: ventilation sufficient to prevent escape of contaminant into worker's breathing zone, which is generally at the opening of the booth or room; worker usually not required to wear respirator. (see Figure 2)

E. Local exhaust hoods

1. updraft, overhead, or canopy hood; worker under hood: air drawn upward through the breathing zone in this arrangement; therefore often necessary to provide respiratory protection.
2. updraft, overhead, or canopy hood; worker outside or at edge of hood: air drawn across breathing zone into hood; worker usually does not require respiratory protection; hood edge may be considerably below the breathing zone in the case of small processes. (see Figure 3)
3. sidedraft, crossdraft, or backdraft hood: exhaust hood placed at side or rear of dust, smoke, or vapour-producing process with respect to worker's location; clean air drawn across the breathing zone into the hood. (see Figure 4)
4. downdraft exhaust hood or grille: ventilation air passes through the breathing zone down across the contaminating process and into some form of grille or slotted opening at bench or floor level.
5. narrow slot exhaust hood: air drawn across the surface of a tank or table into a narrow slot along one or more outer edges of the equipment; general movement of air downward through the breathing zone.
6. spot or point exhaust hood: small round or rectangular opening located close to source of air contaminant, but frequently made adjustable; air drawn into hood from all directions unless restricted by flanges around edge of the suction opening. (see Figure 5)

Fig. 2. Portable grinding stand with booth-type enclosure and air-recirculating dust collector. Courtesy American Air Filter Company, Louisville.

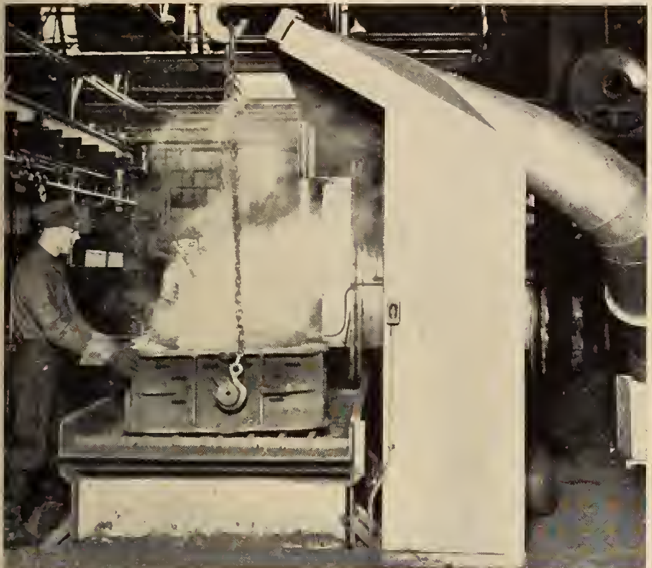


Fig. 3. Semi-canopy, inclined hood for casting shakeout process. Clear air drawn across breathing zone. Courtesy C. B. Schneible Company, Detroit.

7. special contour or close-fitting hood: highly specialized shape of hood or suction tube designed to enclose part of the process or follow closely the contour of the machine or tool creating the air contaminant. (see Figure 6)
8. integral local exhaust hood: built into the machine by the manufacturer with portions of the structure serving as air passages; frequently difficult to maintain in efficient condition, and user may find it necessary to scrap or by-pass the integral exhaust unit, and install a serviceable device on outside of machine.

F. Combination supply-exhaust systems

1. " push-pull " ventilation: air blown across zone of contamination into receiving hood which exhausts primary air stream together with room air set into motion by induction; if dusty work must pass through supply jet or screen, there is danger of blowing much dust into room out of reach of exhaust opening.
2. supply-exhaust hood or enclosure, independent of room air: outdoor air conveyed directly to process enclosure where it picks up contaminant and is then exhausted outdoors; if worker not required inside, objective may be saving of heated room air in cold weather; if worker inside, he may require respiratory protection; may also be used to provide faster cooling of hot processes where worker is stationed outside; note similarity of this item to D-1 and D-2, which however can be handled by exhaust alone, with sufficient air inlets communicating with workroom atmosphere. (see Figure 7)

Some of the above types of process ventilation are illustrated in the figures accompanying this paper. It will be evident that the arrangement of this classification is generally from the simplest to the most complex methods of air control; this makes the classification also approximately chronological, from the earliest procedures to those applied to modern mechanized industry.

General and Local Ventilation

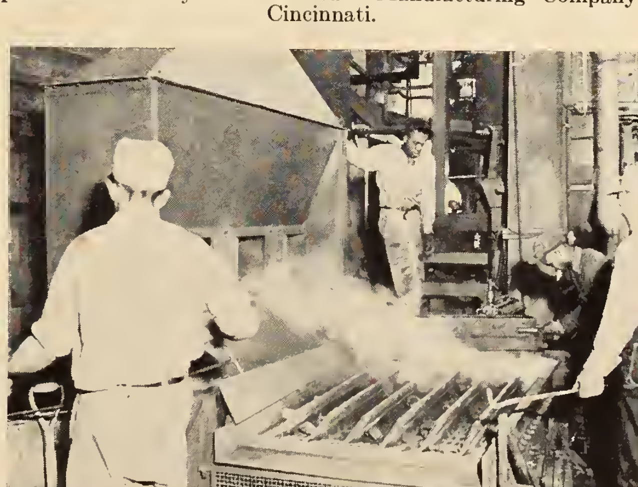
Recent experiences have made it quite evident that there is no sharp line that can be drawn between local and general ventilation in industry. Although single local exhaust hoods commonly do their work without removing significant amounts of air from the workspace, the collection of a large number of locally exhausted devices in a single room may result in tremendously high rates of air change within the room. In some cases the local exhaust hoods fail because of the impossibility of getting enough air into the room without extensive alterations, while in others the rates of air change produced by the local hoods are discovered to be many times higher than the most extravagant amounts of general ventilation that might have been used without any of the elaborate hoods and ducts.

The case of a propeller-type wall fan is of interest. Although usually regarded as a simple example of equipment used for general ventilation of the space, careful observation in some plants has disclosed the fact that the gradually accelerating airstream as it approaches the fan, if located near the breathing level, may be capitalized as a form of local ventilation. A process stationed against the wall and near or under the fan has the kind of ventilation described under item C-2 in the classification offered above. Nevertheless, the fan may have the essential job of creating general ventilation for the entire workroom as a means of diluting other minor and scattered air contaminants.

One serious disadvantage of general ventilation is the impossibility of recovering all the contaminant once it has been allowed to escape into the room air. Control is principally a matter of diluting the dispersed dusts, smokes, or gases to permissible concentrations. The building or room may serve as a large settling chamber for particulate air contaminants, which is specially dangerous in the case of combustible dusts or powders. Accumulations of flammable dusts on rafters and machinery surfaces over periods of months or years have resulted in disastrous explosions when a mechanical shock or vibration and a source of ignition combine to create the conditions of explosibility.

Local exhaust ventilation prevents the spread of air contaminants throughout the building atmosphere with surprisingly small quantities of airflow in com-

Fig. 4. A sidedraft exhaust hood on a casting shakeout process. Courtesy Kirk & Blum Manufacturing Company, Cincinnati.



parison with the volumes of air required by general ventilating systems. In spite of this possibility of air conservation by the use of local ventilation, there are highly persuasive reasons why general ventilation is so often selected by industrial managements: 1. simplicity and low cost of natural ventilation; 2. relatively low first cost of motorized general ventilation; 3. absence of interference with manufacturing operations; 4. flexibility in plants with constantly changing machinery arrangements; 5. existence of contaminating processes throughout the entire workroom, making elaborate ductwork unsightly and cumbersome; 6. desire for fan equipment capable of handling large volumes of air in plants located in mild climates or during hot weather in northern climates; and 7. discovery that local exhaust systems do not eliminate the necessity of supplying large volumes of heated air in the wintertime to replace that escaping from loosely constructed buildings; this volume of air supply may be more than sufficient to dilute the process air contaminant to a satisfactory level.

Reinforcing Ventilation Rates

As the population of ventilated processes increases in a given space, the rate of general air change in that space mounts to surprising values. At least, there may be an element of surprise in the results if consideration has not been given to the fact that local ventilation gradually becomes general ventilation as the room space per ventilated unit becomes less. Attempts to enforce inflexible standards of process ventilation without regard for the volume of air space in its environment have largely been responsible for the discovery of this principle.

A single open-top tank of volatile liquid located in the center of a large manufacturing area requires a rate of ventilation that will overcome the normal air disturbances produced by surrounding activities. Its effect in producing general ventilation in the space may be negligible, even though a very high airflow rate per unit of surface area is in use. This same tank installed in a small room specially designed for the operation may create a drafty condition at the doorway due to the demand of the exhaust system on the tank. Computation of the amount of air required to dilute the escaping vapour down to a reasonable level for comfortable and safe breathing may disclose that the local exhaust system on the tank is removing air at several times this satisfactory dilution rate. It may still be wise to remove the air from the room by way of the exhaust hood already attached to the tank, but it may also be quite sound to reduce the ventilation rate, even below the value that may have been selected as the standard for a conventional installation.

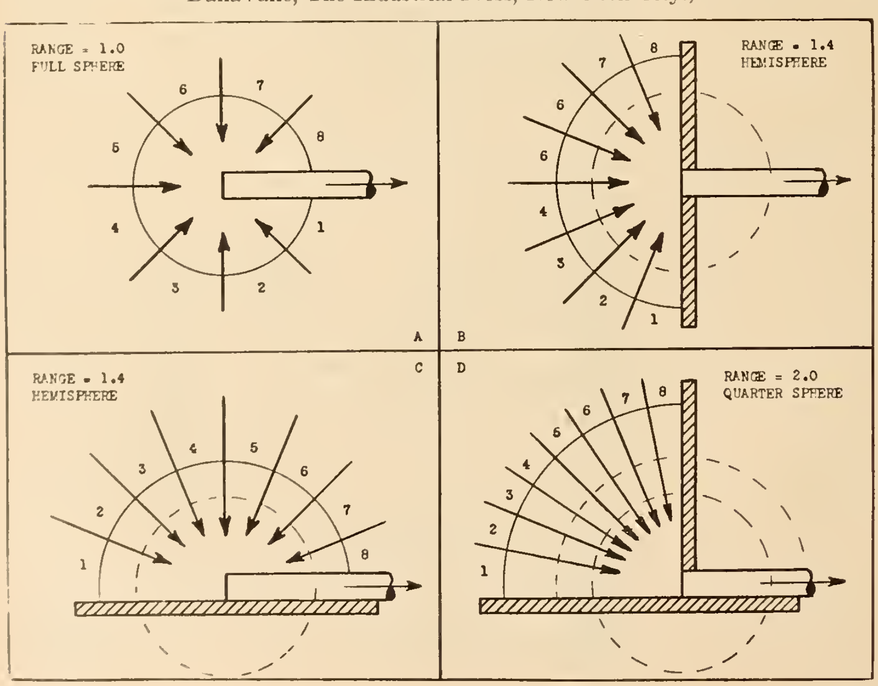
Returning to the tank in a large space, if it is desired to increase the output of the operation by installing more tanks in the same area, the principle of "reinforcing ventilation" may emerge in the course of experiments with the equipment at varying rates of airflow.

The new installation may result in eight tanks arranged in two rows of four tanks located back-to-back. The exhaust rate for a single tank may be 200 cfm. per square foot of liquid surface, in order to overcome normal room air disturbances. Assuming a surface area of 15 square feet, a slot-type exhaust hood mounted around the four edges should remove a total of 3000 cubic feet of air per minute. If the bank of eight tanks is similarly ventilated in consideration of the same room air disturbances, the total air exhaust rate would be 24,000 cfm. This reaches proportions that call for a critical study of the job in the interest of airflow and heat economies.

As the quantity of air moving into a given location on a manufacturing floor increases, the influence of general air disturbances becomes less serious. Momentary surges or gusts of indoor wind may disturb the air pattern over the ventilated equipment, but the large mass of air moving toward it at relatively low velocity from all directions rapidly dilutes any escaping contaminant, and eventually carries it back to the zone of influence of the exhaust openings. This has been observed by smoke tests in the vicinity of tanks, booths, bench or floor grilles, and canopy hoods. To be sure, the worker's breathing zone will not be absolutely clear of contamination, but industrial hygienists do not demand a zero concentration result.

Movement of a large mass of air toward a rapidly ventilated section of a manufacturing floor makes it possible to revise the unit airflow rates downward in the wintertime when heat must be conserved. Such reduction in the airflow rate per unit of ventilated process does not endanger the successful control of air contamination as feared at first glance. Each ventilated unit appears to be helping each other in the area to overcome the effects of air disturbances, or the tendency of air contaminants to escape from the process and get beyond the range

Fig. 5. Flanges and baffles increase the zone of influence of exhaust openings. (For more accurate velocity contours and streamlines, see "Exhaust Hoods" by J. M. DallaValle, The Industrial Press, New York City.)



of influence of the exhaust hoods. The hoods " reinforce " one another; their air velocity contours may overlap; their influence on the general drift of air in the surrounding space is mutually supporting.

Returning then to the example cited above, instead of 24,000 cfm. as the total ventilation rate for the bank of eight tanks huddled in a group, it is quite possible that the rate can be cut 50 per cent or down to 12,000 cfm. which results in a rate per unit of liquid surface of 100 cfm. per square foot. This same rate might prove to be quite inadequate for a single tank competing with its environment alone in a large workroom. The effect cannot be ascribed simply to the aerodynamics of exhaust slots in the production of a given control velocity at some point above the tank. It is a function of the volume of environmental space per unit of the process subjected to exhaust ventilation. It definitely offers support of the assertion that local and general process ventilation may be intimately related in a specific installation. It even reveals the possibility in some cases of achieving the same results without the elaborate sheet metal work of individual exhaust hoods, but instead with simple general exhaust ducts terminating in the center of a compact contamination zone.

Large and Small Installations

In the example outlined above, it may logically be pointed out that if eight tanks operating in one area can be controlled by the combined effect of exhaust and dilution with a rate of 100 cfm. per square foot of tank area, why should it be necessary to use 200 cfm. per square foot in the case of a single tank? The fact is that if " still air " conditions could be maintained in the plant it would be possible to protect the breathing zone of the operator in both cases with approximately the same exhaust rate, 100 cfm. in this instance. However, the eccentricity of indoor air currents appears to be the important variable in the discrepancy between large and small installations of process ventilation.

If a steady drift of air occurs always in a direction that will move across the worker's breathing zone and over the source of contamination, it may even be possible to dispense with the exhaust hood entirely. But if the drift of air is in the opposite direction, from the process toward the worker, his own exposure is exaggerated, even though other workers in the vicinity may be protected by the gradual effect of dilution. It appears therefore that the answer to the question posed in the preceding paragraph is that small exhausted processes cannot influence the fluctuations in room air currents to the same extent as large exhausted processes, and that accordingly the dilution effect at the breathing zone is less dependable for small processes.

Successive Ventilation

A useful concept in the interest of economy is " successive ventilation." This means that air which is eventually removed from a plant is routed through several areas in succession, always in the direction of increasing air contamination. It is thus required that air leaving one area be acceptable as the supply for the next space through which it passes. The result of passing air through several spaces before wasting it to the outdoors is a saving both in air horsepower and in heat or refrigeration.

A logical course of airflow in the application of successive ventilation is from offices to manufacturing areas that are relatively free from contamination, thence to spaces in which local exhausted processes are stationed. Furthermore, if high-quality air cleaning devices are incorporated in the local exhaust systems, part or all of the air may be returned to the workroom before it is eventually removed from the building through motorized ventilators independent of the exhaust systems.

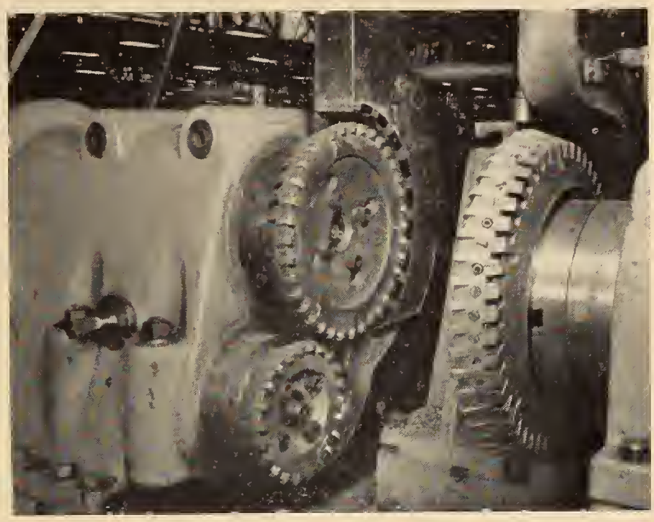


Fig. 6. A special contour exhaust hood at the edge of cast iron milling cutters. Courtesy Detroit Diesel Engine Division, General Motors Corporation.

In some plants the quantity of air handled by a local exhaust system is entirely adequate to provide simultaneous general ventilation for all other parts of the plant. Air openings can be placed so that air reaching the local exhaust hood passes over the largest possible surrounding area, thereby doing its full share of general ventilation. On the other hand, if a " short circuit " is allowed to exist between the exhaust hood and a nearby window or roof ventilator, some parts of the work space may receive little or none of the intended air circulation.

Short Circuits in Air Movement

Short circuiting is the term commonly applied to the movement of air directly from an air inlet to an air outlet, when they are so near one another that very little mingling of the airstream with room air can occur. Clean air entering the building leaves again without carrying off its share of interior impurities or heat. The usual implication is that short circuiting is inadvertent and quite wasteful of the energy expended in creating air movement. Short circuiting is not, however, an invariable handicap. If outdoor air can be short circuited directly to an exhausted process without coming in contact with workers, substantial heat saving may result.

One designer, on observing that a large exhaust system was creating an air-bound room, decided to short circuit the outdoor air directly to a large number of ventilated tanks, instead of passing it through the entire space between the building walls and the processing area. The cold air was brought in through vertical stacks located a few inches above each tank and it travelled horizontally to slot-type exhaust hoods. The low temperature of the air actually proved to be an advantage in holding it down near the tank surfaces, and since it did not pass through the working zone, no one was subjected to cold drafts. (See similarity of item F-2 in the classification presented above.)

A Summary of Considerations

The purchase of industrial ventilating systems is seldom facilitated by the kind of well-documented specifications that have been developed for other kinds of mechanical equipment for buildings. The standards for process ventilation do not deal so much with the behaviour of the air and its contaminants as with the durability or safety of fabrication. Satisfactory operation of the equipment is frequently taken for granted without testing in the absence of customer complaint, and the bases for design may even be treated as trade secrets by some concerns.

The following list of considerations is certainly not complete, for each job will present difficulties that must be met by engineering judgment. Nevertheless, if these items are carefully reviewed at the time new installations are planned, disappointments or failures are sure to be infrequent.

Fig. 7. Supply-exhaust booth for grinding on automobile body solder. Note worker with air-supply hood. See items D-1 and F-2 in classification, page 592. Courtesy R. C. Mahon Company, Detroit.

(1) Cold weather operation presents one of the most serious problems in process ventilation. Unless provisions have been made to replace the air removed by the exhaust system, it is likely to fail for lack of air. This is especially true for low-pressure systems in which the fan cannot overcome the resistance of airflow through window or door cracks when the building has been tightly closed to conserve heat. The owner must face the fact that removal of heated air from the building as a means of carrying away dangerous air contaminants cannot continue for more than a few minutes if air does not enter the building in equal amounts. Natural leakage will compensate for small rates of exhaust in a large building. Large exhaust rates in small buildings are impossible in the winter if tempered make-up air is not provided.

(2) The practicable control velocities for process ventilation are relatively low when compared with the drafts or convection currents that might be present in the manufacturing space. For this reason it is imperative that all such disturbances be prevented so far as possible, preferably by mechanical barriers or baffles designed as integral parts of the exhaust hood, and placed in a manner that will not interfere with the worker's activities.

(3) The air velocity induced by an exhaust hood decreases approximately with the square of increasing distance from the source of air contaminants. In the interest of air economy, the designer should keep this distance at a minimum. If an adjustable hood is proposed, thought should be given to the good possibility that the operator will forget or refuse to keep the hood within the proper distance selected by the designer, because this fact may influence the choice of some other method of control.

(4) Many processes induce air movements or displace air alternately from one point to another in the course of operation. If exhaust hoods are planned to keep contaminated air under control, care must be taken to determine or estimate as well as possible the velocity or volume of air movement churned or pumped by the process. Examples include the air displaced by bagging or packaging of powdered or granular materials, escape of air from compressed air devices, air shoved aside by the travel of a drop hammer, air entrained by materials falling down a chute, and air thrown out by the centrifugal action of rotating devices.

(5) Make certain that all ducts or enclosures containing contaminated air are under suction with respect to the indoor atmosphere wherever possible. This will influence the choice of location for the blower or exhauster. Sheet metal construction is certain to develop leaks in time, and if ducts or enclosures are carrying contaminated air under pressure, eventual leakage into the room is inevitable.

(6) Perhaps it is unnecessary to mention the requirement of duct velocities capable of preventing the settlement of dusts with the gradual constriction of cross-section areas. Examination of existing systems gives the impression that such a provision is seldom obeyed; or perhaps the information on minimum transport velocities for some dusts is rather inaccurate. At any rate, this item is the key to many disgusting hours of maintenance labour on dust control systems.

(7) While it may be rather appealing to have large portions of an exhaust system welded together for strength or durability, do not close up the equipment so thoroughly that the maintenance department will require an acetylene torch to get its cleanout equipment inside. Even those systems that are not tightly welded together for long distances are too frequently installed without consideration for the maintenance department. The designer is often to blame for faulty maintenance.

(8) In the case of an existing installation of process ventilation that does not perform properly, make certain that it has been restored to its initial operating condition so far as mechanically possible before concluding that new equipment must be purchased. Air handling equipment deteriorates so gradually in some cases that memory alone is not sufficient to compare original and present performances. Rarely has the plant operator recorded the air volumes and velocities carried by the equipment during its early days of use.

(9) If an existing system seems to function poorly even after thorough cleaning, have the rotating direction of the centrifugal fan checked. Axial-flow fans give unmistakable evidence of their direction of rotation, but centrifugal fans do not reverse the direction of airflow when their rotation is reversed. Consequently the fact that air continues to travel into

(*Continued on page 600*)

THE BITUMINOUS SANDS OF ALBERTA
AS A
SOURCE OF LIQUID FUELS

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An abstract from a paper presented at the Fuel Economy Conference at The Hague, Holland, September 2-9, 1947*

The authors believe higher prices, falling production, better results from experimental separation and refining of bitumen, drilling results, and access to German techniques, call for a review of the possible utilization of our bituminous sand resources. Current production and consumption of petroleum on the Prairies is outlined, and the sources and volumes of competitive raw materials for synthetic liquid fuels are discussed. The bituminous sands are described, as well as present methods of separating bitumen from sand and converting bitumen to gasoline. European hydrogenization processes, particularly the German, are dealt with. Concluding, the authors contend that technical problems of separation and conversion are partly solved but require further investigational work.

The large occurrence of bituminous sand in the vicinity of McMurray in Northern Alberta has been known for many years but has never been exploited commercially on a large scale[14]. Recently, however, a combination of circumstances has arisen which calls for a review of the situation with regard to this resource, namely; increasing imports and rising prices of petroleum; the definition by core-drilling of richer areas of bituminous sand; recent experience with methods of mining bituminous sand and separating bitumen from it; experimental work on refining methods; and the availability of information on German technique for converting heavy asphaltic oils to gasoline.

Petroleum Supply in Western Canada [10][12]

If the Alberta bituminous sands were developed, the market immediately available would be the prairie area of Western Canada. Consumption in this area is greater than production. Imported oil comes from mid-continent and Texas fields and is expensive because of the long haul.

Consumption of the prairie area in 1946 was 13 million barrels, or 47 per cent greater than in 1940, but the upward trend may not continue. 1946 production was 6.9 million barrels, almost entirely from the Turner Valley field. This field reached its peak of production in 1942 and its annual output is now declining about ten per cent per year. The difference is presently made up by imports, but might possibly in future be supplied from synthetic liquid fuels manufactured from bitumen or other raw materials, if exploratory effort fails to discover adequate new fields of natural petroleum.

Raw Materials for Synthetic Liquid Fuels

Bituminous sand is not the only raw material to be considered. There are also in the prairie area natural gas, coal and a type of heavy crude oil that can not be refined to gasoline by ordinary methods.

Recently much work in the United States has been directed towards development of methods for converting natural gas to liquid fuels [16][18]. The methods are based on conversion of natural gas to a mixture of carbon monoxide and hydrogen. Processes based on these methods are claimed to be a radical improvement over the German Fischer-Tropsch type of synthesis. One of them is soon to be tested in a full-scale plant. In 1946 the consumption of natural gas in Alberta and Saskatchewan was $4.4(10)^{10}$ cubic feet and the known reserve in Alberta as at January 1945 was of the order of 10^{12} cubic feet. [2] The reserve is therefore not unlimited, and the question of how great a supply should be made available for synthetic oil production remains to be answered.

Coal is a second competitive raw material. The German liquid fuel supply during World War II was produced principally from coal. It is believed, however, that both the hydrogenation and Fischer-Tropsch processes as applied in Germany are too costly to be employed profitably in Western Canada and the use of coal is contingent on major improvement of one of these methods. Extensive research in this field is now in progress in the United States and it is possible that improvements will be made. There are in the prairie area adequate reserves of coal, ranging from medium volatile bituminous coal to lignite, to supply any anticipated need[19].

A third competitive raw material is heavy asphaltic crude oil that is not amenable to refining by ordinary methods. This oil is chemically similar to bitumen, and it might be used to supplement the supply of bitumen at a common refinery.

The bituminous sands appear to have some advantages over the competitive materials as a source of gasoline and other liquid fuels. The reserve of bitumen will probably not be a limiting factor, as it may be for natural gas and heavy crude oil. Bitumen has fewer alternative uses than natural gas. It will probably require a less expensive processing procedure than coal. The bituminous sands are however not well located in relation to the market; no completely satisfactory method of separation has been demonstrated on a large scale; and special methods are required for refining the separated bitumen to gasoline.

Characteristics of Bituminous Sands [13][4]

The bituminous sands are situated along both banks of the Athabaska River and cover an area not less than 1500 square miles. Bordering the Athabaska River and its tributaries, the sands are exposed or lie under very light overburden and thus can be mined by open-pit methods. The bitumen is largely in the form of thin films surrounding individual sand grains. The bitumen content is ordinarily less than 18 per cent by weight but in some locations much richer concentrations of "liquid" bitumen have been discovered. The water content of the bituminous sand and of the "liquid" bitumen is also variable.

*This paper, together with a record of the discussion, will be included in the *Transactions* of the Conference to be published in the near future.

The Department of Mines and Resources has investigated the extent and nature of the bituminous sands intermittently since 1913. The most recent information has been obtained by core drilling in selected areas adjacent to the river north of McMurray(15). Here an extensive deposit of sand containing 12 to 18 per cent by weight of bitumen, under light overburden, was found. Some occurrences of "liquid" bitumen were also discovered. The area drilled up to the end of 1946 is tentatively estimated to contain not less than 350 million barrels of bitumen.

Methods of Separating Bitumen from Sand

Bitumen can be separated from sand by washing with hot water. The sand is first agitated with hot water and air which displaces the bitumen films from the sand. Clean sand sinks while a froth consisting of bitumen, air, water and fine sand floats to the surface and is removed. No commercial scale separation plants have been built but three pilot plants utilizing the hot-water method have been operated.

The separation plant of the Research Council of Alberta, south of McMurray, has been described by Clark and Pasternack(5). Bituminous sand and sodium silicate were fed into a mixer and thoroughly mixed and heated, then discharged into a trough together with a stream of hot water. The materials flowed to a heated separation box where bitumen froth floated to the surface and was collected. The froth was then fed to a steam jacketed settling tank for separating the fine sand. The bitumen was fed to a steam-heated dehydrator and discharged. It then contained five per cent of inorganic mineral matter and one per cent of water.

The original semi-commercial Abasand Oils pilot plant has been described by Ball.(1) In it the bituminous sand was first mixed with hot water in a rotating pulper. The bitumen films were separated and entrained with air bubbles. Contents were discharged into a flotation cell and the froth passed on to a second flotation cell. The froth from the second cell was mixed with a light oil diluent. The diluent was recycled after subsequent distillation. The diluted oil was discharged into a settling tank to separate sand and water. The diluted bitumen produced contained less than three per cent of water and less than two per cent of sand.

Experiments at Abasand Oils in 1945 indicated that bitumen can be separated by water and oil diluent at ordinary temperatures. Plant tests using over 100 tons of bituminous sand per day were conducted, indicating a high recovery of bitumen. Laboratory investigations indicated that separation at temperatures between 70 and 90 deg. F. was better than at lower temperatures. It was also indicated that bitumen can be separated satisfactorily from bituminous sand with 10 per cent of clay.

Methods of Converting Bitumen to Gasoline

Methods of conversion must adjust the hydrogen-to-carbon ratio by adding hydrogen or removing carbon; remove sulphur, nitrogen, oxygen, and inorganic matter; remove asphaltenes or convert them to hydrocarbons; and reduce the molecular weight. The gasoline must be given satisfactory volatility and combustion properties of which a high octane number is the most important.

Modifications of cracking processes have been extensively tested as methods for converting bitumen to gasoline and other useful products(14). A simple refining process based on thermal cracking was operated by Abasand Oils. Experimental runs indicated the following yield of products could be expected from treatment of the bitumen by this process.

Products	*Per cent by weight of bitumen charge*
Gasoline	7
New Diluent	6
Diesel Oil	10
Fuel Oil	16
Residuum	60

The gasoline produced in this refinery did not meet commercial specifications regarding sulphur content and would require further treatment.

More recently the Universal Oil Products Company developed a more elaborate process for the production of aviation gasoline from bitumen. The essential steps in this procedure were as follows:

1. Once-through thermal coking of the crude bitumen.
2. High-temperature catalytic cracking of the acid-treated crude distillate.
3. Low-temperature catalytic treating of the depentanized gasoline from coking.
4. Recovery and treatment of pentane and lighter hydro-carbons in the gases produced in the cracking operations.
5. Isomerization of normal butane.
6. Alkylation of butylene and amylenes with isobutane.

It is estimated that the yields from this process would be as follows:

	Yield as per cent of bitumen refined
Aviation Gasoline	22 per cent by volume
Motor Gasoline	17 " " " "
Fuel Oil	17 " " " "
Coke	21 " " " weight

The aviation gasoline would have a sulphur content of 0.04 per cent and an octane number, unleaded, of 87.5; with 4.8 c.c. of tetra ethyl lead per imperial gallon its octane number would be over 100. The motor gasoline would have a clear octane number of 73 to 74. It thus appears that satisfactory aviation and motor fuels can be produced from bitumen by the process outlined.

Hydrogenation has been applied to bitumen only in small scale experimental work. There have been unpublished investigations by commercial companies but only Research Council of Alberta(3) and the Department of Mines and Resources(20) have reported in the technical literature.

Recent unpublished work by the latter has verified the possibility of producing high yields of sulphur-free, low octane gasoline from bitumen by a two-stage procedure involving primary sump phase hydrogenation followed by vapour phase treatment of the middle oil product. This experimental procedure indicates that a satisfactory technical process can probably be developed, though it may not be economical enough for commercial success.

Materials similar in some respects to bitumen have been hydrogenated on a large scale in Europe. Two plants in Italy, at Bari and Leghorn, have used hydrogenation as a means of converting Albanian crude oil to gasoline(9). There were also two oil hydrogenation installations in Germany, one at Politz operating on petroleum residuums, and another at Lutzkendorf operating on asphaltic residues from the manufacture of lubricating oil .

Briefly, the process applied to petroleum residuums in Germany consisted of primary sump-phase hydrogenation at 700 atmospheres with a suspended iron catalyst. It yielded a middle oil as net product, purified by hydrogenation at 300 atmospheres over a fixed bed of tungsten sulphide catalyst (I.G. number 5058). It was finally converted to gasoline by further hydrogenation. This procedure is parallel to the one employed for coal. The yield of gasoline was high, amounting to 109 per cent by volume of the primary raw material.

If the German technique were applied in Western Canada to bitumen there would be other advantages. Bitumen has a considerable distillable fraction which could by-pass the relatively expensive sump phase operation and go directly to the intermediate purification step. Natural gas could be used for the manufacture of cheap hydrogen.

In Canada less expensive processing methods than the German technique could probably be employed. If inorganic material and asphaltenes were removed by destructive distillation the distillate could possibly be treated over an active catalyst without primary sump phase hydrogenation. Possibly also the vapour phase treatment could be accomplished in a single stage by higher pressure. Again raw bitumen might be treated at high pressure, over a fixed, active catalyst, thereby retaining the high yield of gasoline while eliminating the sump phase stage . There are in fact a large number of processing techniques that offer the possibility of reducing the cost of hydrogenation in its application to bitumen.

These processing techniques are made up of various combinations of the following separate operations.

1. Generation of hydrogen from natural gas or gaseous hydrocarbon products, possibly under pressure to reduce compression costs.
2. Destructive distillation of raw bitumen to coke to remove asphaltenes and inorganic matter.
3. Sump phase hydrogenation to remove asphaltenes and inorganic matter.
4. Mild hydrogenation over active but durable fixed catalysts to remove asphaltenes.
5. Intermediate hydrogenation to prepare middle oil for conversion to gasoline of high octane number.
6. Conversion of purified middle oil to gasoline of high octane number by hydrogenation over catalysts such as I.G. 6434.
7. Conversion of purified middle oil to gasoline of high octane number by catalytic cracking with recycling of the residue from cacking through the hydrogenation step.
8. Conversion of raw middle oil to gasoline of high octane number in a single operation by employing special hydrogenation techniques.

Something is already known of all of these operations and the development of the optimum process will consist in applying them to bitumen, in improving them, and in selecting the most economical combination under Canadian conditions. The Bureau of Mines is now preparing to investigate the operations that involve hydrogenation.

It is safe to conclude that methods based either on catalytic cracking or on hydrogenation are technically capable of producing satisfactory gasolines from bitumen. The cracking method is however, inherently wasteful of the raw material, and the hydrogenation process that has been applied to similar materials in Germany is expensive. Yet, by taking advantage of favourable conditions and by developing improvements in technique, the cost of the hydrogenation method probably can be reduced.

Summary

The bituminous sand occurence in Alberta is not uniformly high-grade, but parts of it are extensive and rich enough to supply a large-scale industry. The major liquid fuel requirements in the region are gasoline and other light fuels, and any large scale utilization of the bituminous sands will probably be as a source of these products rather than heavy fuel oils. Competitive raw materials that must also be considered are further supplies of natural petroleum, and natural gas and coal which may conceivably be utilized as sources of synthetic liquid fuels. If these competitive raw materials prove to be inadequate in quantity or can be converted to gasoline only by relatively expensive processes, commercial exploitation of the bituminous sands will be contingent on development of methods for separation of the bitumen from the sand and converting it to gasoline. The technical problems involved in separation and conversion are already partly solved but their complete solution will pobably require further intensive investigational work.

APPENDIX

Since the manuscript of the foregoing paper was prepared, articles have appeared in technical and popular journals describing the release of oil from sedimentary materials by the action of bacteria. Fundamental research on this subject has been conducted for several years by Dr. Claude E. ZoBell at the Scripps Institution of Oceanography of the University of California at La Jolla, California. Alberta bituminous sands have been among the materials with which he has experimented and it has been demonstrated in the laboratory that certain bacteria are capable of releasing the bitumen from the sand. A patent based on bacterial separation, United States Patent No. 2,413,278, has been granted to Dr. ZoBell and assigned to the American Petroleum Institute. A paper published in the *Oil and Gas Journal* in June, 1947, emphasized the possibility of applying bacterial separation to the Alberta bituminous sands(21).

The principle of bacterial separation may conceivably be capable of development into a technical method for removing bitumen from sand, but up to the present, there is not enough information to justify an estimate of the probability of its success. In this connection, the following statement has been quoted from a recent paper by Dr. ZoBell:(22)

" The observations summarized above are based upon laboratory observations. Operators who are interested in applying the bacterial process to the secondary recovery of oil are warned that it is a tremendously large step from the test tube to an oil well. Whether sulfate reducers, methane producers, hydrogen producers, or other types of bacteria in pure culture or combinations will grow and liberate oil from oil-bearing sediments in subterranean deposits as they do in test tubes is purely conjectural. Before any positive recommendations can be made, much more experimental and development work will have to be done by trained microbiologists working in close co-operation with petroleum engineers. Although it is definitely a wildcat proposition with the odds against immediate success, the vast quantities of oil locked in sediments should offer adequate incentive for a thorough exploration of the possibilities of the bacteriological process."

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INDUSTRIAL PROCESS VENTILATION

(*Continued from page 596*)

exhaust hoods, even though at reduced rate, leads some to believe that the fan cannot possibly be running in the wrong direction. When motors are removed for servicing, they are occasionally reconnected improperly by the electricians, who are then likely to assume that airflow *into* the exhaust openings is sufficient evidence of correct rotation.

(10) Give some consideration to the potentialities of airborne nuisance in the neighborhood. Industrial plants will not continue much longer to be huge settling chambers for the particulate matter created or released within their walls. The demand for better indoor conditions is gradually transferring the dust loads from the inside to the outside in those places where air cleaning devices have not been incorporated as part of the process ventilating system. While the outdoor air has a substantial capacity for absorbing air contaminants, the dilution process requires time and favourable weather conditions, and the immediate neighbours of the plant are likely to receive the major portion of air pollution on many days in the year.

(11) Do not plan to return contaminated air to the plant after passing through air cleaners unless the performance of the cleaning equipment is well understood. It should be realized that the ability of the cleaner to retain a given percentage by weight of the impurities in the air passing through is not a satisfactory criterion for respiratory safety. The quantity of contaminant *remaining* in the air after it has been cleaned is the important fact for the designer or user Unless the manufacturer can provide convincing evidence that return of air from his equipment to the workroom atmosphere will not cause excessive contamination in the breathing zone, any such proposal should be accepted on a strictly experimental basis at the manufacturer's risk.

(12) If air recirculation through some type of cleaning or separating device is proposed as a means of retaining the heated air within the building, make certain that all the costs associated with the air cleaning apparatus are carefully estimated and summarized for comparison with the anticipated savings in heat (or refrigeration in the summer). It might turn out to be cheaper as well as less trouble to spend money for heat and discharge the air directly outdoors, provided the heating plant can stand it, and provided a neighborhood nuisance can be avoided.

(13) The location of air supply openings within the plant should be planned to give the most complete cross ventilation practicable. Care should be taken that clean air passes over the breathing zones toward the areas of contamination so far as possible.

(14) With respect to the outdoor atmosphere, clean air inlets to the building should be located remote from contaminated air discharge stacks to avoid recontamination of the indoor air. Brisk winds on some days will carry impurities directly from discharge stacks over to the inlets if a safe distance has not been provided.

(15) Have the performance of process ventilation checked by airflow instruments after the installation is complete to verify its ability to perform as promised. If the ventilating equipment is for the purpose of maintaining air contaminants below a stated level in compliance with official regulations or management standards, air samples should be taken and analyzed by a competent industrial hygienist.

THE COLUMBIA BASIN WATER RESOURCES IN CANADA

A Review of Investigations now in progress for the International Joint Commission

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A paper presented to the Vancouver Branch of The Engineering Institute of Canada, on October 8, 1947

This paper describes the Columbia River Basin and the developed power sites within its boundaries, both in the United States and Canada. It discusses the various surveys and investigations currently being carried out by the International Columbia River Engineering Board, for the International Joint Commission. The personnel of the Board, are listed, and progress to date in each phase of the work is given. In conclusion, a summary is made of the benefits from these studies that will accrue to the people residing in the Columbia Basin and to the Dominion at large.

The Columbia River basin is situated in the Cordillera on the Pacific slope of the North American Continent. Its river system comprises one of the large international drainages shared by Canada and the United States. It includes approximately 259,000 square miles, between north latitudes 41 and 53 degrees and west longitudes 110 and 124 degrees. Of this vast area some 39,700 square miles form the southeast portion of the Province of British Columbia, while the 219,300 square miles include almost all of Idaho, the greater part of both Oregon and Washington, western Montana and relatively small areas in western Wyoming, northwestern Utah and northeastern Nevada. The greatest width of the basin, from western Wyoming to the Pacific Ocean is 728 miles, and its maximum length, from its most northerly limit in British Columbia, to its southerly boundary in northern Nevada, is 818 miles.

Projects in the United States

Studies and investigations leading to the systematic development of the water resources in the United States have been proceeding for many years. Vast expenditures have been made by Federal and State Governments and private interests in the construction of works for power, irrigation, flood control, navigation, and other uses.

The Columbia River has a fall of nearly 1,300 feet from the International Boundary to the sea. Some 438 feet of this head is already absorbed in three existing power plants. Eight additional potential power developments on the main stem of the Columbia River in the United States have been examined. All of these will utilize the total developable head of the river in that country. The construction of two has already been approved, the Foster Creek site, some 50 miles below Grand Coulee, with a proposed installed capacity of 960,000 kw., and McNary Dam at Umatilla, Oregon, with a proposed installed capacity of 690,000 kw.

Two outstanding Federal hydro-electric projects on the main stem of the Columbia in the United States are: Bonneville, at Bonneville, Oregon, completed in 1943 with a capacity of some 518,400 kw.; and Grand Coulee at Coulee Dam, Washington, with a present capacity of some 781,000 kw. and an ultimate capacity of 1,974,000 kw. Both of these installations are multi-purpose, Bonneville serving navigation and power, while Grand Coulee was constructed mainly in the interests of irrigation and power. The Puget Sound Power and Light Company's Rock Island Project near Wenatchee, Washington, completed in 1933, has a present rated capacity of 80,000 kw. The ultimate capacity is 220,000 kw.

Projects in Canada

There are at present no sizable Federal hydro-electric projects in operation on the Columbia system in Canada. The principal Canadian developments on this system include the five plants on the lower Kootenay River, operated by the Consolidated Mining and Smelting Company of Canada and the West Kootenay Power and Light Company, with a total installed capacity of 258,090 kw., utilizing the total fall of the Kootenay River from Kootenay Lake to its confluence with the Columbia River; and the two plants on the Elk and Bull Rivers, operated by the East Kootenay Power Company, with a total installed capacity of 16,560 kw.

Studies in Canada

It has long been known that Canada possesses a water resource of great potentialities in the Columbia River system. The main stem of the Columbia falls 1,350 feet from Columbia Lake to the International Boundary. Included in the Columbia River system are tributaries of considerable magnitude, including the Kootenay, Pend d'Oreille, Flathead, Moyie, Kettle, Okanagan, and Similkameen Rivers.

While some studies of the water resources of certain portions of the Columbia River system in Canada have been made for various purposes, there has been no overall survey of the water resources in the Basin. The authorization for the present study of this great river permits the securing of a tremendous amount of basic and fundamental data and the subsequent study required to evolve a co-ordinated plan for the most economic overall development of its water resources.

Reference to International Joint Commission

Pursuant to the reference dated March 9, 1944, to the International Joint Commission by the Governments of Canada and the United States, the International Columbia River Engineering Board was appointed by the Commission in 1944, to investigate and report upon the feasibility of further development of the water resources of the Columbia River Basin. The present personnel of this four-man Board are Mr. V. Meek, M.E.I.C., controller, Dominion Water and Power Bureau; Mr. F. G. Goodspeed, M.E.I.C., assistant chief engineer, Department of Public Works, Ottawa; Brigadier-General R. C. Crawford, deputy chief of engineers, United States Army, and Mr. C. G. Paulsen, chief hydraulic engineer, United States Geological Survey, Washington, D.C. To carry out the field in-

Top left: **Columbia River at Trail, showing the Consolidated Mining and Smelting Company of Canada plant.**

Centre left: **Columbia River at Athalmer—high water of June, 1946.**

Bottom left: **Columbia River at Surprise Rapids on the Big Bend. In the foreground is the Sno-cat used for winter transport in this area.**

Above: **Elk River, showing the Elko power plant of the East Kootenay Power Company.**

Right: **West Kootenay Power and Light Company Limited No. 5 on the Kootenay River at Brilliant, about one mile above the Columbia River, where two generating units with rated capacity of 34,000 hp., when operating under 85-foot head, are installed. The power house is designed to hold four such units.**

vestigations the Board appointed the International Columbia River Engineering Committee which now consists of Colonel L. H. Hewitt and Dr. F. A. Banks as United States Members, and Mr. K. W. Morton, M.E.I.C., district engineer for British Columbia-Yukon District of the Department of Public Works, Canada, and myself representing Canada. Mr. W. C. Warren, engineer of the Dominion Water and Power Bureau, is in charge of the field work.

Field Investigations

A full-scale programme was immediately inaugurated in Canada by the Canadian section. During the latter part of 1944 substantial progress was made in the correlation and evaluation of basic data already available, which included numerous reports on the topography, hydrology, geology, climatology, as well as on the potential or developed resources of portions of the area under review.

The early part of 1945 saw the commencement of intensified field activities, including aerial photography, geodetic surveys, topographic mapping, bathymetric surveys, reconnaissance surveys, geological and dam site investigations, hydrological studies, climatological studies, soil surveys, and fish and wild life studies. Substantial progress in all of these phases of investigation has been made since the inception of work.

Aerial Photography

While aerial photography had been carried out in some sections of the Basin prior to the inauguration of this investigation, the coverage of the river valleys which are of particular interest was incomplete. Accordingly, arrangements were made with the Royal Canadian Air Force to photograph some 15,700 square miles of river valley areas at suitable scales, the coverage of the photographs to extend to a minimum elevation of five hundred feet above the valley floor in all cases. To ensure satisfactory results, photography was restricted to the low water periods and times when snow was absent from the lower levels; hence the periods suitable for this phase of activity are quite brief. In spite of these limitations, the photographic programme is now almost complete. Prints of the photographs have been made available for use as soon as possible after being taken; and have proven of great assistance in conducting the surveys.

Geodetic Surveys

Horizontal control for mapping the water courses in the basin was fairly complete when studies were initiated, having been established by the Dominion Department of Mines and Resources, and by the Geographical Branch of the British Columbia Department of Lands and Forests. Two gaps in the coverage of the control, one from Nakusp southward to the International Boundary, and one along the West Arm of Kootenay Lake have been closed, the former by the British Columbia Department of Lands and Forests and the latter by the Dominion Department of Public Works. The only additional triangulation contemplated at present is to cover the Slocan Lake and River Valley.

Vertical control established by the precise levelling operations of the Geodetic Service constitutes the basis for elevations obtained in all the present surveys in the basin in Canada. At the beginning of this investigation precise levels were only available in portions of the basin. Satisfactory coverage required the running of nearly one thousand miles of precise levels, including several new lines, and the re-running of some sections of the existing net. Among other new lines run during this programme is the line from Donald to Revelstoke via the Big Bend Highway. This work has been undertaken by the Geodetic Service of Canada and is now complete. In addition to this programme the correlation of vertical control along the International Boundary has been completed by the Geodetic Service of Canada and the United States Coast and Geodetic Survey.

Topographical Mapping

The topography in the Basin when the investigation commenced was not available in the detail required for these studies. It was therefore arranged to have the Legal Surveys and Map Service, Surveys and Engineering Branch, Department of Mines and Resources, carry out the field surveys necessary to provide adequate topographic maps. Field work is nearing completion in the valleys of Kootenay River and Lake, the Similkameen River from Princeton to the International Boundary, and the Columbia River from the outlet of Lower Arrow Lake to below the confluence of the Kootenay River.

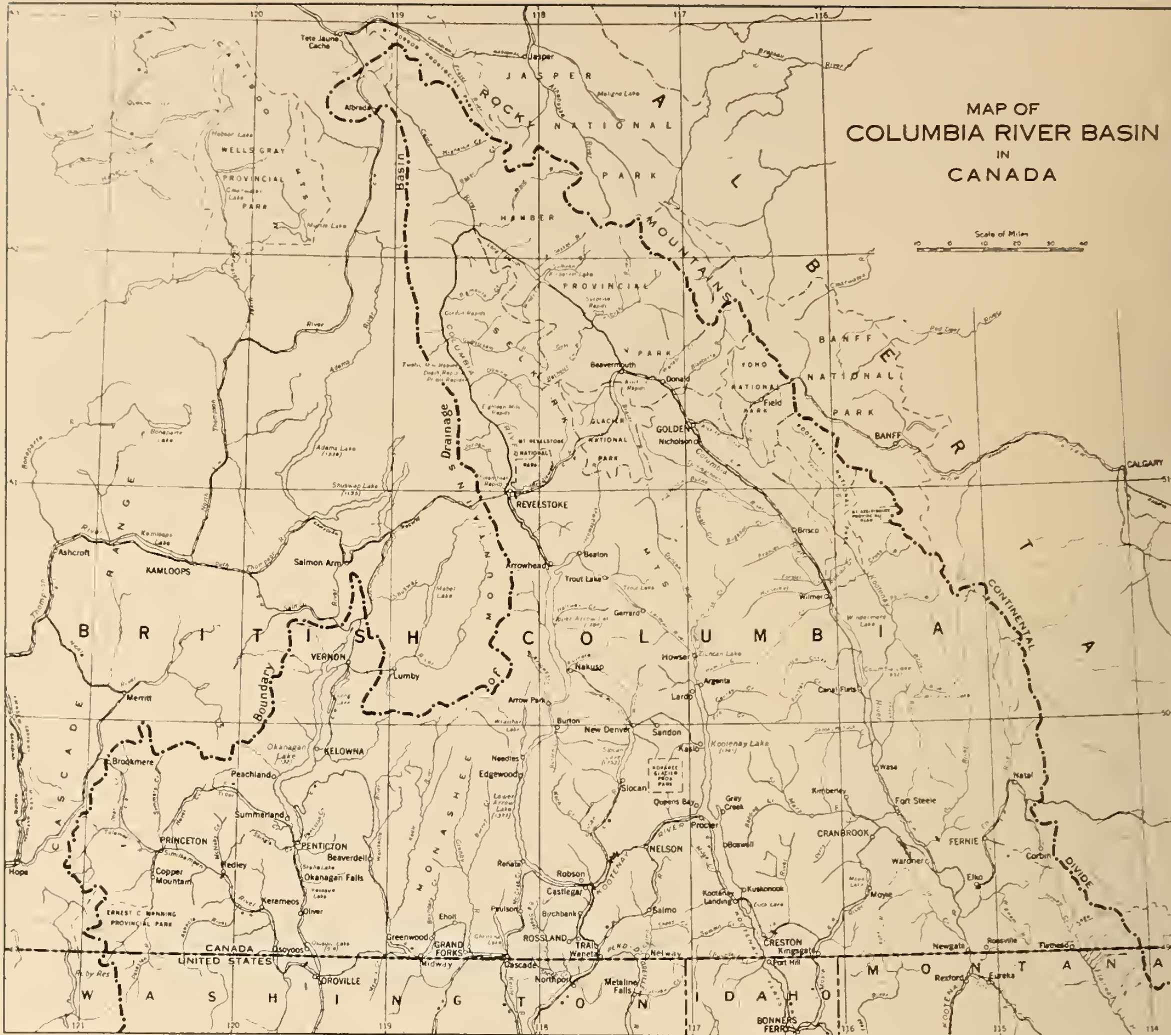
Map sheets of these areas are in course of preparation. Two scales are in general use; one of 1,000 feet to the inch with 2-foot contour interval is being used for the Kootenay Flats area in the vicinity of Creston; the other of one-half mile to the inch and 20-foot contour interval, with 10 and 5-foot contours on the flatter slopes and benches. is being used in the remainder of the mapping. For the Okanagan River Valley, the Joint Board of Engineers' Okanagan flood control topographic map with a scale of 400 feet to the inch and 2-foot contours to an elevation of ten feet above water level is available for reference.

Bathymetric Surveys

Underwater contours of selected reaches of the rivers and lakes in the Basin are being determined in the bathymetric survey by the Department of Public Works of Canada. Areas surveyed to date include the north and south ends of Kootenay Lake, as well as the West Arm; also the Columbia River from the outlet of Lower Arrow Lake downstream to below its confluence with the Kootenay River. The work is at present continuing on the Lower Kootenay River from Grohman Narrows to Corra Linn Dam, and will be extended on the main Columbia River from Castlegar to the International Boundary. This bathymetric work is being tied in to the topographic surveys where they intersect.

Reconnaissance Surveys

In order to provide preliminary information as early in the course of the investigation as possible, particularly with respect to possible dam sites, storage reservoirs and irrigable areas, and to direct the more detailed examination of such possibilities, the Dominion Water and Power Bureau has operated, during the past three field seasons, a number of survey parties engaged in river reconnaissance on the Columbia, Similkameen, Kootenay, Wigwam, Goat, Duncan, and Lardeau Rivers. From these surveys reconnaissance map sheets are being prepared. These have been completed for the Upper Kootenay, Dun-



can and Lardeau Rivers. The scale is one-half mile to the inch, with 20-foot contour interval, varied as necessary to suit the topography.

Geological and Damsite Investigations

The reconnaissance surveys already referred to have indicated fourteen damsites in the Kootenay portion of the Basin, the potentialities of which warrant more detailed examination. Nine sites have been given preliminary surface examinations by the Geological Survey, Department of Mines and Resources. Three sites have been given more detailed geological examination, and availability of construction materials has been given some study. Some test drilling for foundation studies has been done at Gibraltar Rock, eighteen miles above Canal Flats. Drilling operations are now in progress at a site near Torrent, some twelve miles below Canal Flats.

Hydrological Studies

These investigations may be divided into two main classifications; surface water and ground water studies. Unlike many phases of investigation, water stage records over a long period of time are essential. The Dominion Water and Power Bureau has, in the course of the past thirty-five years, established a fairly comprehensive system of stream gauging stations and water stage recording stations on the Columbia River system in Canada. For various intervals during this period, records have been obtained at 483 stations, of which 143 were all year, or open water periods.

However, in view of the complete coverage of the water resources of the Basin being considered in this investigation, it has been deemed necessary to extend the system of stream gauging. Present indications are that at some forty locations new stations are to be established, or substantial improvements to existing equipment are essential. Of this number, some twenty-five stations have been established or improved. This involves the construction of substantial gauge shelters, stilling wells, metering equipment, including erection of cableway river crossings, and installation and maintenance of water-stage recorders.

Prior to 1945, studies of ground water conditions in the Basin in Canada had been very limited in extent. During 1945 a system of wells was installed in the Kootenay Flats in the vicinity of Creston by the Dominion Water and Power Bureau. Since then these investigations have been extended to selected points in the Kootenay and Okanagan Valleys. It is planned to make systematic ground water investigations in the Upper Columbia Flats in the vicinity of Golden, and to extend these studies as warranted.

Climatology

Meteorological and snow survey coverage of the Basin has been studied, and additions to the present coverage are being made. Some ten new snow survey courses have been established in the last two years, and ten others are planned to give more adequate coverage of the Basin. This work is being done by the Water Rights Branch of the Department of Lands and Forests of British Columbia, with the active co-operation of the Dominion Water and Power Bureau. The meteorological coverage is considered to be only fair, as while there are many stations in the Basin, the distribution is naturally in the settled valley areas. These areas do not in all cases represent the meteorological conditions of the individual Basins, as conditions are frequently very different at various elevations. This is particularly true of precipitation. Additional weather stations are being established in more inaccessible areas.

Soil Surveys

Soil surveys have this year been initiated in the Basin in Canada by the British Columbia Department of Agriculture with the co-operation of the Department of Agriculture of Canada. While some soil surveys had previously been made in isolated areas, this is the first systematic survey of soil conditions in all of the potential agricultural lands of the Basin. Upon the results depend the feasibility of many potential irrigation and reclamation projects, as well as determination of the crops which may be cultivated to the best advantage.

Forest Resources

About thirteen per cent of the productive forest land in British Columbia lies within the Columbia Basin. According to the Forest Service report of the British Columbia Department of Lands and Forests, dated 1937, the total merchantable timber in the Columbia Basin in Canada at that time was approximately 22 billion fbm., of which about 14 billion fbm. were classified as accessible. The Forest Service is continuing its appraisal of these extensive resources.

Mineral Resources

Mineral resources form a large part of the natural wealth of the Columbia Basin in Canada. Although most of the deposits are incompletely delimited, it can safely be assumed that very important mineral reserves remain to be discovered or explored.

Fisheries Problems

The Fisheries Research Board of Canada is initiating studies of conditions in the Columbia Basin and the possible effects on fish life of dams, storage, or diversion works, that may be recommended for construction as a result of this investigation.

Recreational Resources

Extensive recreational areas with a very wide range of climatic and topographical conditions form a distinct resource of the Columbia Basin in Canada. Consideration is being given to their value by the various agencies concerned.

Conclusion

This brief sketch of current activities will serve to indicate the scope and extent of this investigation. In addition to the handicaps of personnel and equipment shortages common to all investigations today, climatic conditions limit the field season. Transportation, particularly in the Big Bend area, constitutes a major obstacle in winter. As an aid to the survey activities during winter months, the Dominion Water and Power Bureau has acquired a vehicle for transportation over snow and ice, which gave a satisfactory performance last winter, and is the first of its type to be used in Canada.

While the results of the surveys and investigations by various agencies still remain to be co-ordinated, it is evident that, by careful planning, development of the water resources of this great basin may be successfully utilized for the benefit of future generations in the Province of British Columbia. Some 250,000 acres of potential agriculture lands await development and settlement in the Kootenay Valley between Canal Flats and the International Boundary. An additional 100,000 acres lies between Canal Flats and Donald on the Columbia River. The precipitation in this region is low, particularly in summer, and for this reason farming has been hazardous. With an adequate supply of water for irrigation, the area would support a number of successful farming communities where good transportation is already available.

By the construction of dams of some magnitude in the Upper Columbia and Kootenay Rivers, multiple benefits will accrue to areas downstream. These benefits include irrigation, reclamation, flood control, and hydro power. One interesting example of a multipurpose project would be the development of a storage reservoir in the vicinity of Canal Flats by the construction of two dams, one on the Upper Columbia River below Columbia Lake, the other on the Kootenay River south of Canal Flats. Such a reservoir would impound both the waters of the Kootenay and Columbia Rivers, from which water could be released as required either down the Kootenay or down the Columbia. The flood control benefits would permit the reclamation of a considerable area in the Columbia Valley, as well as give material protection to reclaimed lands in the Kootenay Valley downstream, particularly in the vicinity of Bonners Ferry, Idaho, and Creston, B.C., where already over 50,000 acres of highly productive land have been reclaimed.

This entire investigation and appraisal is based on the realization that a large part of the water resources of Canada and the United States in this important river basin are not being utilized because of the lack of effective regulation and control. With an efficient measure of control the Columbia River system may be regulated to provide benefits of many kinds; additional power plants may be installed and output from present plants increased, lands now arid may be made productive by irrigation, other lands now subject to flooding may be reclaimed, flood damage along the water courses may be minimized, and the prosperity and well-being of the people who reside in the Columbia Basin and adjacent areas greatly expanded. In addition, increased prosperity of a region such as this great basin adds also to the prosperity of the entire Dominion of Canada.

ELECTRICAL ENGINEERING AS A CAREER

F. L. LAWTON, M.E.I.C.
Assistant Chief Engineer, Aluminum Company of Canada, Montreal, Que.

A paper presented at a symposium for students, sponsored by the Student Guidance Committee of the Montreal Branch, Engineering Institute of Canada, November 22nd, 1946

Enumerating the many applications of electrical engineering, the author outlines the scope of the electrical engineer's contribution to each. A definition of an electrical engineer is quoted, and the numerous qualifications required for the profession are listed. In conclusion, the Engineer's Creed, as set forth by the Engineers' Council for Professional Development, is repeated.

In dealing with the subject of electrical engineering as a career, it is well to relate it to the engineering profession as a whole. One of the great engineering institutions in the United Kingdom has defined engineering as "the art whereby the great sources of power in nature are converted, adapted, and applied to the use and convenience of man". Actually, an engineer may be defined as a practitioner of applied science, which is the art of applying in the interest of human welfare the whole fund of knowledge of those natural laws which have governed the work of master builders since prehistoric times. It has been stated that the duty of the engineer to preserve and expand this knowledge (or science), and the obligation laid upon him to use it with all possible skill for the general good, are the main factors characterizing his work as a profession.

Electrical engineering is one of the six main branches of engineering, and is itself subdivided into a large number of fields of specialization. It is frequently somewhat obscured in the public mind by late developments, such as radar or television. Actually these specialized fields of endeavour form only a small part of the entire field of activities of the electrical engineer.

The ramifications of electrical engineering are extremely broad. It enters into practically every phase of scientific and technical activity; in fact, today, the very fabric of civilization. Its broad branches may be set forth as follows: communications; power systems; industrial establishments; transportation; electrochemistry and electrothermics; mining; illumination; electrical equipment manufacturing; electronics; instrument engineering; electrolysis; and nuclear energy.

Communications

While electrical engineering had its first faint recognition in 2634 B.C. when Hoang-ti, the mythical founder of the Chinese Empire, is supposed to have constructed the first magnetic compass (perhaps the compass was not invented until 1110 B.C. by Ki-Tan), nevertheless it made its first real impact on civilization when Samuel Morse devised his first telegraph instrument in 1836. From this springs the communications branch of electrical engineering. The communications field is itself sub-divided into a number of branches. These are: telegraphy (overhead and trans-oceanic cables), telephony, space radio, television and radar.

You are all familiar with telegraphy and telephony, so I do not need to comment on this at any length. Space radio, of course, includes broadcasting with all its ramifications. For instance, there is A.M. and F.M. broadcasting; high-fidelity wire channels for network operations; transcription work; etc. Then, too, there are point-to-point applications of radio as for general communications work, ship-to-shore and ship-to-ship.

Television is still in its infancy, but there is no doubt the future will see large numbers of television broadcasting centers dotting all civilized, highly-developed countries. Such television broadcasting centers will involve high-fidelity interconnecting circuits, whether they be of the point-to-point type or utilize co-axial cables.

I doubt if anyone is today completely un-informed on radar. You all know its application for military purposes, primarily detection of enemy aircraft, surface and underwater vessels, while they are still sufficiently far away interception and destruction can be accomplished. However, radar will prove, I am sure, a far greater boon to humanity in the control of aircraft, both in flight and while landing at busy airfields. A further important use of radar which is now beginning to shape up is its application to shipping, so that vessels can proceed in narrow waters without fear of collision or running ashore. In this connection, it will be particularly useful on the North Atlantic, where shipping must contend, frequently, with numerous icebergs. Radar will undoubtedly serve in future to invisibly but safely mark busy air and seaborne shipping lanes.

Facsimile transmission is another branch of communication which will blossom forth in your lifetime, with the news and items of general interest being printed in the office, club and home, hot off the griddle of fast-moving world events.

Power Systems

The power systems branch of electrical engineering, frequently termed central station engineering, had its inception in 1882 when the first commercial central station in the world for incandescent lighting started operation at 57 Holborn Viaduct, London, on January 12th, to be quickly followed by Thomas A. Edison with the first electric lighting plant in the United States, the Pearl Street Station of the Edison Electric Illuminating Company in New York, on September 4th. This was followed by the first hydro-electric plant in the world, at Appleton, Wisconsin, on September 30th.

Central station engineering naturally includes all phases of generating plants, whether they be hydro-electric, steam or diesel. New developments are bringing the gas turbine to the fore as a prime mover for central stations. And the time is probably not far distant when we will have great central stations powered by atomic energy.

Once generating capacity is made available in central stations, there arises the problem of transmitting this power to the load centers, which may be great metropolitan areas like Montreal or the widely diversined industries and communities such as we find in the Eastern Townships. Transmission is normally overhead but in restricted metropolitan areas it is frequently underground by means of high-voltage cables.

At the load centers it is necessary to step down the transmission voltage to voltages suitable for distribution to the consumer, whether they be large power-consuming industries, a multitude of small industrial and commercial establishments or the ordinary household. While a great deal of distribution is still by overhead lines, the trend, especially in cities and the more progressive towns, is to utilize underground cable networks entirely.

One very important phase of central station engineering is system protection. Generating stations, transmission lines and distribution circuits must all be provided with protective relaying and circuit breakers so that when a breakdown occurs the defective generating plant, transmission line or distribution feeder can promptly be cleared from the system without occasioning disturbance to customers.

Loads and Rates

The great power networks of today have become so extensive, and reliability of service is so important, that their operation requires skilled system engineers, who utilize available capacity and sources of energy on the system to best advantage. For instance, in the great hydro-electric systems, such system operators must plan in advance the loads which can be carried. They must prognosticate the inflow to storage reservoirs or the discharge of the rivers on which run-of-stream plants are located.

Not the least of central station engineering work is the problem of rates. Loads vary so widely between consumers, as for instance the large industrial plant on the one hand and the small domestic consumer on the other hand, that the problem of equitable service rates is really an extremely large one. Some customers have the type of load which is on the system 24 hours a day, 7 days a week and in all probability 365 days a year. The load fluctuates very little from hour to hour and day to day. Other customers may operate their establishments only eight hours a day and there may be rather sharp peaks in that load. For instance, street railways have large rush-hour peaks, so that the central station system supplying them must have generating plant capacity adequate to meet the need at the peak load, though it does not sell them energy at all comparable to the capacity which must be kept available for the service. Some consumers utilize power at high power factors; others at low power factors. It costs the central station relatively much more to carry the low-power factor load than it does the high-power-factor load. Hence, the matter of fair rates is a very involved one. Then, too, there are regulatory commissions whose rulings on rates must be taken into account.

Industry

Electrical engineering plays a very large part in general industry. Manufacturing establishments all have their problems of power supply, distribution, application of motors and their control, and lighting, in greater or lesser degree. In smaller plants these problems may not be very heavy and may be taken care of by a good electrician. Larger plants may require one or more electrical engineers, capable of designing extensions and alterations in production lines, as well as operation and maintenance. Mass production plants of the paper-mill type, rolling mills, etc., utilize relatively complex electrical controls because the trend is more and more to automatic control, and this in particular requires the fullest ability of the electrical engineer.

Transportation

The electrical engineer has wide scope in the transportation field. I imagine you are all sufficiently familiar with street railway systems and you can visualize just where the electrical engineer enters into their activities. Many of you are no doubt acquainted with electrified railways, at least those portions with which the travelling public comes in contact. However, what you do not see are the transmission lines and feeders, power plants, complex signal systems, etc., all the work of the electrical engineer.

Perhaps a few of you realize the extent of electrical engineering activities in aerial navigation. The modern transport plane is literally a small but complex central-station system. There may be large numbers of generators all tied together through busses and feeders to the motors serving the various functions.

Instrumentation has reached a very complex state in aircraft today. Then there is radio and, of course, the latest development, radar. Airport lighting systems owe their present stage of development to the electrical engineer. Traffic controls at the great airports depend on the electrical engineer in the first instance, for radio communication, teletype links with meteorological bureaux, radar and all the multitude of electrical aids which enter into aviation today.

Even shipping is turning more and more to the electrical engineer, what with electrical propulsion equipment, diesel-electric power plants, lighting, etc. Navigation on restricted waterways such as the St. Lawrence and the Great Lakes hinges on navigation lights, many of which are electrical with automatic lamp changes, sun switches, etc.

Electrochemistry and Electrothermics

The vast wartime expansion in the light metals industries, such as aluminum and magnesium, hinged on the close-working partnership of chemical engineers and electrical engineers, these industries being based on electrochemistry and electrothermics. Great aluminum smelting plants at Arvida, Shawinigan Falls and elsewhere utilize enormous amounts of direct current power, obtained by converting the alternating current supply from central station systems by means of, in the older installations, synchronous converters, and during the last few years mercury-arc rectifiers. The electrical engineer plays a vital part in these, from the power-conversion end down to the cell line proper and through all the multitude of subsidiary plants necessary for such industries. Then, too, such industries and many others utilize electric furnaces for metals melting, purifying, alloying, heat-treating, tempering and many other operations. Furnaces vary from resistance types to induction types, in a multitude of forms, each best suited to a certain operation.

Mining and Prospecting

The skill of the electrical engineer plays an essential part in the mining industry all over Canada, as mining today depends on electrically-operated hoisting gear with its rather complex control, transportation and lighting in the mines, frequently power mucking and electrically-powered machinery in the mills where the ore is processed and the final product made ready.

Electrical prospecting is coming more and more to the fore. While such equipment is ordinarily handled by a geophysicist, its design and general application depends on the electrical engineer.

Other Applications

The electrical engineer specializing in illumination work may be concerned with lighting in homes, offices or industrial establishments, airports, freight yards and playing fields. The work of the illumination engineer ranges from research through design to application.

The electrical manufacturing industries, of course, are one of the greatest fields of activity for electrical engineers. Work may comprise research through design and application to manufacturing, whether it be large waterwheel generators, motors or small household appliances.

The great struggle for freedom, which has given way to the desperate struggle today for peace in which all peace-loving nations are engaged, saw an immense impetus given to electronics. This phase of the electrical engineer's work embraces such branches as radio, industrial electronics, television and radar. It perhaps may be described as largely concerned with research, design and manufacture. As applications are in such widely diversified fields the application engineer specializing in those fields must perforce know how to apply electronics in his daily work.

A particularly interesting phase of the electrical engineer's work is that of instrument engineering. Every field of activity into which he enters is concerned with proper instrumentation for control and metering purposes.

The application of direct-current power in large blocks, as for electrified railways, street railways and electrochemical work brings in its train a highly-specialized field of activity for the electrical engineer—that of stray-current electrolysis mitigation. While highly specialized, and engaging only a few engineers, nevertheless it is extremely interesting.

Finally, the electrical engineer must not overlook nuclear energy, because it will undoubtedly be applied for central-station prime movers, ship propulsion equipment and possibly main-line locomotives, etc. The electrical engineer will be particularly concerned with the manufacture of atomic fission materials, as plants for such are probably the most complex and exacting in regard to remote control and instrumentation that have yet been developed.

Definition of an Electrical Engineer

In summing up the field of activities of the electrical engineer I would like to give you the Encyclopedia Britannica's definition of an electrical engineer, which is,

> The electrical engineer is one who is able to conduct or direct work involving the theory and practical application of electricity. The work of the electrical engineer may include research, design, construction, operation and management and also writing and teaching on any of these branches. The practical application of electricity, in which the great majority of electrical engineers are employed, may be divided into generation, distribution, control and utilization of electrical energy. Utilization may include use of mechanical power produced by electrical devices as in transportation and industrial-machine operation, illumination, communications, electrochemistry, electrometallurgy, electrical heating, measuring by electrical means and use of electronics forces as in X-rays, cathode rays, etc.

Qualifications

Now what are the abilities which a young man desiring to enter that branch of the engineering profession known as electrical engineering must have? He must have the possibility of developing his mind, so that eventually he may have what may be called an engineering mentality. The work of the professional engineer is done with the head, so that mechanical aptitude, while of value, is not nearly as essential as the ability to think clearly and logically.

He must have a sound preparation in mathematics, especially if thinking of research and design work. Many engineers overlook this necessity because they have gone into those phases of professional activities which are administrative or supervisory. Nevertheless, although the individual engineer may make little direct use of mathematics in his every-day work, sound mathematical training is most important because it enables him to develop his thinking abilities and arrive at the correct relation between cause and effect.

The would-be engineer must have a clear and patient mind, because many engineering projects take weeks, months an even years of study before a sound solution is found. This means there is a great accumulation of data, so that the capable engineer needs ability to think clearly in order to assess the significance of any particular solution or phase of the project.

The would-be engineer needs a good mastery of English, because his work involves the transmittal of information orally or in writing. He must sell the projects on which he works to his superiors, and nothing succeeds so well in this aspect as clarity of expression.

Ability to co-operate is most essential, because engineering projects today involve such wide ramifications through all branches of the engineering profession that team play between individual professional engineers and with sub-professional workers such as skilled technicians, skilled and unskilled labour, is necessary to create the finished work.

The would-be engineer must appreciate that the pursuit of an engineering career means a striving after truth and exchange of information with his fellow engineers through the medium of the voluntary and professional engineering societies. The engineer who would succeed must realize that his training does not cease with graduation from college or university, does not cease with his first few years in industry or laboratory, but continues throughout his professional life. Only by co-operation with his fellow engineers in the broader field afforded by the professional and voluntary technical societies can he render to society that service which is the true measure of the real professional man.

The Engineer's Creed

I would like you to bear in mind the " Faith of the Engineer " which was developed by the Committee on Principles of Engineering Ethics of the Engineer's Council for Professional Development. It runs:

> I am an Engineer. In my profession I take

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AN INTRODUCTION

to

WIND TUNNELS AND THEIR PROBLEM

W. G. DeHART, M.E.I.C.,
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Practically all that is known about the aerodynamic properties of bodies is the result of wind tunnel testing. Wind tunnels permit of continuous, rapid, and methodical testing methods. This fact, coupled with the tremendous savings in expense by tunnel tests, makes wind tunnels indispensable in the development of new aeroplane designs.

Now, naturally, the wind tunnel data is only of use as it can be applied to the full scale aeroplane—it is here that the chief problem of the wind tunnel arises. In order for the dimensionless coefficients which have been devised, and which are measured in the wind tunnel, to be directly applicable without correction to a full scale aeroplane, the flow pattern and all other factors in the tunnel must be exactly the same as in the full scale case. Exact similarity cannot be obtained, as will be presently explained.

Turbulence Factor

Not only is it impossible to obtain similarity in conditions from model to full scale in any one tunnel, but the amount of turbulence in the flow varies from tunnel to tunnel. Turbulence is defined as the ratio of the square root of the deviations of the speed from its mean value, to its mean value. Therefore, even to compare results from one tunnel to another we must use a turbulence factor.[1] The use of the turbulence factor suffices for the comparison of results from tunnel to tunnel. When we come to compare results from model to full scale for any one tunnel, however, we find the solution more difficult.

By the use of dimensional analysis it can readily be shown that, for an uncorrected applicability of results at least, the following dimensionless factors must be the same in the two cases.

1. Reynold's Number $= \dfrac{\text{Velocity} \times \text{Length}}{\text{Kinematic Coefficient of Viscosity}}$
2. Mach Number $= \dfrac{\text{Velocity}}{\text{Velocity of Sound}}$
3. $\dfrac{\text{Force}}{\text{Density of Fluid} \times \text{Velocity}^2 \times \text{Length}^2}$
4. Shape.
5. Angle of Attack.
6. $\dfrac{\text{Velocity}}{\text{R. P. M.} \times \text{Diameter}}$ (for propellers).
7. $\dfrac{\text{Modulus of Elasticity of Model}}{\text{Density of Fluid} \times \text{Velocity}^2}$
8. $\dfrac{\text{Acceleration} \times \text{Length}}{\text{Velocity}^2}$
9. $\dfrac{\text{Density of Body}}{\text{Density of Fluid}}$
10. $\dfrac{\text{Roughness}}{\text{Length}}$
11. $\dfrac{\text{Disturbance Velocity}}{\text{Stream Velocity}}$

In going then from a model to a full scale aeroplane, let us first assume that we shall make the two Reynold's numbers the same. If air is used for our tunnel fluid and the velocity is increased, then the kinematic coefficient of viscosity is the same in the two cases, and for a twenty-fifth scale model, with the velocity of the aeroplane, say 300 mph., the velocity of the model must be 7,500 mph. Almost inconceivable power would naturally be required to obtain such speeds, and if the size of the model is reduced to counterbalance the power requirement, then the Reynold's Number decreases directly with the model scale.

To obtain the full scale Reynold's number in the above manner by increasing the velocity would appear to be an impossibility. Here, also, arises a conflict, for in order to have the same Mach Number when using air with the same properties, the velocity of the model must be *equal* to that of the aeroplane. Even this has now become difficult with modern high speed aeroplanes.

Difficulties with the Reynold's Number

We begin, then, to search for other methods to obtain the same Reynold's number. If we try compression of our fluid, where the coefficient of viscosity does not change, then the kinematic coefficient of viscosity varies inversely and Reynold's number varies directly as the pressure. Under such conditions, however, the tunnel requires power which is also proportional to the pressure. At great expense, tunnels must be built to stand the high compression, and we must work under uncomfortable and maybe dangerous pressures, as do deep sea divers. If, then, we use the same power as required for high pressure work, but instead increase the velocity, we find that Reynold's number only varies as the cube root of the tunnel power instead of directly as the power.

Or again, let us try using some fluid such as water, which has a low coefficient of viscosity. From air at

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[1] Turbulence factor is defined as the Reynold's number for a sphere whose coefficient of resistance is 0.30.

$$\text{Reynold's number} = \frac{V \times D}{\nu}$$

where V = stream velocity
D = sphere diameter
ν = kinematic coefficient of viscosity.

$$\text{Coefficient of Resistance} = \frac{D}{\frac{1}{2}V^2A}$$

where D = drag in pounds
ρ = mass density
V = stream velocity
$A = \pi\, D^2 \times \frac{1}{4}$ in square feet.

15 degrees centigrade to water at ninety-five degrees centigrade, the kinematic coefficient of viscosity is reduced fifty times. If velocity and length remain the same as in our air tunnel, Reynold's number is fifty times as great with the water. Under these conditions, however, the power required is 800 times as great, and the drag which we must support also increases 800 times.

Thus it appears that there is no practical solution to the Reynold's number problem. It can be shown that if the Reynold's number were kept the same then the roughness and disturbance velocity conditions would also be satisfied. Even if we could obtain the same Reynold's number, however, both the Reynold's number and Mach number cannot be satisfied at the same time, except at full scale and at full scale speed.

These difficulties would be relatively unimportant if it were simple to take into account the errors in our dimensionless force and other coefficients. But it has been found that they may be in error by as much as several hundred percent, and that the only way of correcting our results is through experience. For this reason there has been a continual effort to obtain greater accuracy by a closer approach to full scale equivalent conditions, through methods similar to those outlined above.

Various Methods Used

The war naturally speeded the impetus of this work. In 1946 a large low turbulence pressure wind tunnel was placed in operation at the Ames Laboratory of the United States National Advisory Committee of Aeronautics (N.A.C.A.). This tunnel has a 12 foot diameter, and actually permits testing of many models at substantially full scale Reynold's number. Although the desired Reynold's and Mach numbers cannot be obtained simultaneously, the same models can also be tested in this tunnel at Mach numbers very close to one by evacuation of the tunnel in separate tests.[2]

Another method, which also allows the same test equipment to cover independently the ranges of Reynold's and Mach numbers, involves the use of freon gas. At the Langley Laboratory of the N.A.C.A. models are whirled at subsonic, transonic and supersonic speeds in a sphere, or propelled in free flight by a compressed-gas catapult at various velocities in air, freon or air-freon mixtures. Also at Langley a research technique known as the "N.A.C.A. wing-flow method" was developed to achieve higher Mach numbers. This involves mounting a small model in the region of high-speed flow over the wing of a high speed aeroplane. Speeds somewhat above those of sound are thus obtained.

By using flexible nozzles a Mach number range of 1.2 to 3.4 could be obtained by the six supersonic tunnels of the N.A.C.A. last year. Because of power requirements these tunnels are, however, necessarily small. One of these, a one by three foot tunnel, also has the facility of pressure change which can be used to investigate the effects of changing Reynold's number.

Because of the great problems encountered in wind tunnel testing at high Mach numbers we might just mention here new flight testing techniques which have been developed. Rocket powered missiles and freely falling bodies as test vehicles, with radar and phototheodolite tracking techniques have come into their own. The wind tunnel remains, nevertheless, one of the chief instruments of aircraft research, along with theoretical and flight test approaches.

[2] Thirty-Second Annual Report of the National Advisory Committee for Aeronautics, U.S. Gov't Printing Office, Washington, D.C., 1947.

ELECTRICAL ENGINEERING AS A CAREER

(*Continued from page 608*)

deep pride, but without vain glory; to it I owe solemn obligations that I am eager to fulfil.

As an Engineer, I will participate in none but honest enterprise. To him that has engaged my services, as employer or client, I would give the utmost of performance and fidelity.

When needed, my skill and knowledge shall be given without reservation for the public good. From special capacity springs the obligation to use it well in the service of humanity; and I accept the challenge that this implies.

Jealous of the high repute of my calling, I will strive to protect the interests and the good name of any engineer that I know to be deserving; but I will not shrink, should duty dictate, from disclosing the truth regarding anyone that, by unscrupulous act, has shown himself unworthy of the profession.

Since the Age of Stone, human progress has been conditioned by the genius of my professional forebears. By them have been rendered usable to mankind Nature's vast resources of material and energy. By them have been vitalized and turned to practical account the principles of science and the revelations of technology. Except for this heritage of accumulated experience, my efforts would be feeble. I dedicate myself to the dissemination of engineering knowledge, and, especially, to the instruction of younger members of my profession in all its arts and traditions.

To my fellows I pledge, in the same full measure I ask of them, integrity and fair dealing, tolerance and respect, and devotion to the standards and the dignity of our profession; with the consciousness, always, that our special expertness carries with it the obligation to serve humanity with complete sincerity.

I would caution you not to expect wealth from a career as an electrical engineer. It will return an income commensurate with ability and application: there is always room at the top of the ladder. But if an ever-widening field of engineering activity, which now forms the very life blood of civilization, appeals to you, with its scope for service to your fellow citizens, and if you have the needful abilities, I can commend electrical engineering as a career.

From Month to Month

News of the Institute and other Societies, Comments and Correspondence, Elections and Transfers

FREDERICK ARTHUR GABY

1879-1947

President of The Institute 1935

Frederick Arthur Gaby, M.E.I.C., a man of vision, an outstanding engineer in the field of hydro-electric development and a skilled organizer, died, in Toronto, on November 14th, 1947. He was in his sixty-ninth year.

He is survived by Mrs. Gaby, the former Katherine Florence MacBeth; two sons, F. M. and R. M. Gaby; two daughters, Mrs. R. F. Porter, Jr. and Mrs. W. R. MacBrien—to whom the condolences of the members of the Institute have been extended.

Dr. Gaby was born at Richmond Hill, Ontario. He graduated from the School of Practical Science, University of Toronto, with the degree of B.A.Sc., in 1903, and those of M.E. and E.E. in the following year.

After three years of practical experience with the Canadian General Electric, Toronto-Niagara Power, and Point du Bois (Winnipeg), he was appointed chief assistant engineer of the Hydro Electric Power Commission of Ontario. From 1912 until 1934 he was chief executive officer of the Commission.

Dr. Gaby was a close associate and friend of the late Sir Adam Beck who stirred up public enthusiasm and support for the development and utilization of the water power resources of Ontario for the benefit of the people. Sir Adam Beck had to overcome a great deal of organized and individual opposition. On all his campaigns through the Province, his constant companion was F. A. Gaby who supplied the facts and figures required by his chief to overcome the arguments of the opponents to his plan. Sir Adam always paid generous tribute to the skill, knowledge and enthusiasm of Dr. Gaby. To these two men the people of Ontario are, indeed, indebted.

During his lifetime Dr. Gaby saw the growth of the Commission into a half-billion-dollar, publicly owned utility. Among other important engineering achievements he was responsible for the completion of the giant Queenston generating station. In 1924, in recognition of his outstanding work as an engineer the University of Toronto conferred on him the degree of Doctor of Science.

His official connection with the "Hydro" was terminated, in 1934, as a result of a change in Provincial Government. But right up to the time of his death he displayed a profound, and understandable, interest in the affairs of the Commission. He will be long remembered for his outstanding contribution to the prosperity and welfare of the people of his native province.

On leaving the Commission he became consulting engineer with Noranda Mines Limited. The same year, 1934, he was appointed assistant to the president of the Canadian Pacific Railway Company and vice-president and general manager of the Seigniory Club Association of Montebello, Que. In 1936 he entered the service of the British American Oil Company Limited as executive vice-president. At the time of his death he was a director of that Company.

He joined the Institute in 1919, and served as president in 1935. He gave unstintingly of his time as a member and officer. He was a Fellow of the American Institute of Electrical Engineers and of the Royal Society of Arts, Great Britain; member and past-president of the Toronto Board of Trade; a member of the Canadian Institute of Mining and Metallurgy and of the Institution of Electrical Engineers of Great Britain. He was also a member of the Associations of Professional Engineers of Quebec and Ontario and of the Canadian Institute of International Affairs.

Frederick Arthur Gaby, M.E.I.C.

THE SIXTY-SECOND ANNUAL GENERAL MEETING

Notice is hereby given, in accordance with the by-laws, that the Annual General Meeting of The Engineering Institute of Canada for 1948 will be convened at Headquarters at eight o'clock p.m. on Thursday, January 22nd, 1948, for the transaction of necessary formal business, including the appointment of scrutineers for the officers' ballot, and will then be adjourned to reconvene at the Banff Springs Hotel, Banff, Alberta, on Tuesday, June 1st, 1948, at eight p.m.

STEAM-GENERATED POWER FOR ONTARIO HYDRO

Of interest to electrical engineers is the announcement that the Hydro-Electric Power Commission of Ontario has contracted for a ten-year period to purchase approximately 30,000 hp. from the Polymer Corporation's plant at Sarnia.

Some of the new power will be made available at 60 cycles to help in meeting a steadily increasing demand from the large new industries in the Sarnia area. The balance will be fed into the Hydro's Southern Ontario system through a frequency changer unit to be built at Westminster transformer station, London.

In January 1947, the thirty-first volume of the *Journal* will commence. For thirty years this publication has served as a means of keeping the members of the Institute informed on subjects pertaining to their profession and the activities of the various branches.

The Council and the Publication Committee have approved of a number of changes whereby, it is believed, the *Journal* will be of even greater value to the reader.

Plans have been made to expand the editorial content in nature and volume. Efforts will be made to improve the appearance of the pages by making greater use of the various type faces which are available, by improving the page " lay-outs " and using a greater number of illustrations.

Because it is known that many members bind their *Journals* by volumes, and others file their copies for future reference, it has been decided to use a higher grade of paper for all issues commencing with Number One, Volume Thirty-one. The Institute has been given verbal assurance by the printer that the required amount of paper will be available.

New Publications Manager Appointed

E. J. BLANDFORD,
Publications Manager of the Institute

The Institute announces with pleasure the appointment, effective January 1, 1948, of Edward J. Blandford as Publications Manager. He succeeds N. E. D. Sheppard, M.E.I.C.

Mr. Blandford was educated at Sir Joseph Williamson's Mathematical School, and Colchester School, England. He studied engineering in Glasgow, Scotland and was apprenticed as an Engineer to the Fairfield Shipbuilding and Engineering Co. Ltd. He served as an engineer at sea and in Venezuela. For the past twenty years he has had active association with Canadian technical and business publications.

In 1928, he joined the staff of the MacLean Publishing Company Ltd., (now The MacLean-Hunter Publishing Co. Ltd.) as Eastern Manager of Technical Publications. In 1933 he organized and operated his own business as a specialist in industrial photography and writing. In 1936, he dissolved his business to establish and manage a Public Relations Department for The National Breweries Limited and it is from that position he comes to the Institute.

In September 1939, Mr. Blandford was given leave of absence by his employers when called for active service as a Naval Reserve Officer. He was appointed assistant to Captain (E) A. C. M. Davy, R.C.N., during the conversion of H.M.S. Letitia and then transferred to the Maritimes to take charge of the conversion, into an auxiliary cruiser, of H.M.C.S. Prince David. On the completion of this work he was promoted to the rank of Lieut. Commander (E) R.C.N.V.R. and appointed Assistant Superintendent of Naval Overseers (Maritimes). He is now on the Retired List of Engineer Officers, R.C.N. (R).

During Mr. Blandford's post-war service with National Breweries the Company publication, *The N.B.L. Review*, of which he was editor, won top awards on three occasions, in the Annual Contest which is sponsored by the Direct Mail Advertising Association. He also directed production of the Company's Annual Report which, in 1946, was declared, by the judges in the Financial World Annual Report Contest to be " The best of Canadian Industry ". For this achievement a silver " Oscar " was presented to the Company.

Mr. Blandford is President of The Canadian Industrial Editors Association and Vice President, representing Canada, on the International Council of Industrial Editors. He is a Commissioner in the Boy Scouts Association.

Advertising Rates Advanced

During the past few months the charges for printing the *Journal* have increased by over 50 per cent. The cost of engravings has advanced by a similar amount and paper prices are, at present, higher than at any other time during the history of our publication.

These increases, together with the Institute's plans for editorial development and expansion have made it necessary to increase our advertising rates, commencing with the January 1948 issue. The new minimum rate will be $120.00 per page.

The leading technical advertisers are regular users of the advertising section of the *Journal* because of their desire to support the Institute and to bring to the readers' attention, in simple form, the facts pertaining to their products and services. Without the support of the advertisers it would not be possible to continue the publication of the *Journal* except by raising the subscription price many times over. The type of advertisement carried in the *Journal* is an asset to any publication and regular perusal of the advertising pages is one of the best methods of keeping abreast of developments in equipment and supplies. The advertisers will be pleased to supply additional information on request.

FOR THE LADIES

Reprinted from an article by Austin F. Cross in the *Ottawa Evening Citizen*, October 14th, 1947.—Ed.

If all the organizations in Ottawa would do what the Engineers' Wives Association is doing, this city would begin to lose its reputation as the coldest social climate this side of the North Pole. Under the presidency of Mrs. K. M. Cameron, they are trying to welcome the stranger within our gates. This association is an organization for the wives of engineers of the city and district. It is designed to make wives of young engineers welcome, also the wives of engineers who have just arrived here. This organization endeavours to see the new and the old get well mixed. The association is open to wives of all engineers regardless of technical associations. Brig. Gen. G. R. Turner, head of the Engineering Institute in Ottawa, eagerly endorses this Engineers' Wives Association, and with the co-operation of the men, is seeking to make the Engineers' Wives Association a really worth-while social institution.

Far too many clubs in Ottawa forget that people keep pouring into Ottawa. Often a young man will get an Ottawa job which he regards as a promotion, and bring his bride to Ottawa. Perhaps she doesn't know a soul, and she has many lonely hours. There are plenty of wives who have been here some time, who have spare hours on their hands, and who would be glad to welcome the younger women. What goes for brides is equally true of older women, who are suddenly uprooted from home and other ties and transplanted to the capital. People past a certain age do not make friends so quickly, and put in many a weary hour here. But the Engineers' Wives Association sets a pattern for all organizations. No matter how small the ground is, they might well form such a club on the distaff side.

Above all, anything that will help people get together is a good thing. Once upon a time, this was a city where anybody knew everybody. Now Ottawa is getting to be a place where nobody knows anybody.

N.R.C. RECOGNIZES IMPORTANCE OF SOIL MECHANICS AND FOUNDATION ENGINEERING

The Associate Committee on Soil and Snow Mechanics which was established in 1945 by the National Research Council has been active in both the Civil and Military spheres of its intended operations. While pursuing the problems of military vehicle operation—the original reason for its formation—the committee has assisted civilian soil mechanics work and, in April of this year it sponsored a conference in Ottawa which coincided with the visit to Canada of Mr. L. F. Cooling of the British Building Research Station.

To continue the liaison which was developed by this conference, the committee has appointed regional representatives. Robert Peterson, M.E.I.C., soil mechanics engineer of the Dominion Department of Agriculture, represents the Prairie Provinces and Mr. D. G. Watt of the Ontario Power Commission sits for the Toronto District. Gordon C. McRostie, Jr.E.I.C., of Ottawa, and Professor Jacques Hurtubise, M.E.I.C., of the Ecole Polytechnique, represent the Ottawa and Montreal-Quebec areas respectively. Professor Spencer Ball, M.E.I.C., of Nova Scotia Technical College is the representative for the Maritime Provinces and a member for British Columbia is yet to be appointed. It is planned to hold occasional discussion meetings in the regional areas and the representatives will be pleased to hear from engineers who would be interested in joining these discussions.

The National Research Council Committee is also the National Canadian Committee for the 2nd International Conference on Soil Mechanics and Foundation Engineering which will be held in Holland in June 1948 to succeed the highly successful First Conference held at Harvard University in 1936. The Canadian Committee hopes that Canada will be well represented not only by papers but by the attendance of a suitable Canadian delegation and interested engineers should contact the Secretary of the Canadian Committee, Mr. F. Lionel Peckover, Jr.E.I.C., c/o Division of Building Research, National Research Council, Ottawa.

Mr. R. F. Legget, Director of the Division of Building Research of the National Research Council, has been Chairman of the Associate Committee on Soil and Snow Mechanics since its inception and he is also Chairman for the National Committee in Canada for the Second International Conference.

ERRATUM

The editorial entitled, "Lachine Waterway to be Studied", appearing on page 486 of the October *Journal* and drawn from a usually reliable source, was in error in stating that the board of engineers appointed to review the 1926 recommendations, is comprised of three members and two assistants.

We are now informed that this is a board of five engineers, with membership as follows: R. A. C. Henry, M.E.I.C., Ottawa; Dr. Arthur Surveyer, M.E.I.C., Montreal; Dr. T. H. Hogg, M.E.I.C., Toronto; Guy Lindsay, M.E.I.C., Ottawa; and C. W. West, M.E.I.C., Ottawa.

MEETINGS OF INTEREST TO MEMBERS

In the public auditorium, Cleveland, Ohio, on January 12th to 16th, inclusive, a Conference on Materials Handling will take place as a feature of the National Materials Handling Exposition.

The theme of the discussion is to be: cost reduction through improved handling; and a few of the topics will be: handling factors in plant layout; handling unusual shapes; vertical, horizontal and inter-floor handling; handling bulk products; time and motion techniques in handling; preventive maintenance of equipment; handling small parts.

In addition to these and many other subjects of interest to engineers, there will be some 180 exhibits of materials handling equipment and a theatre will exhibit films on handling subjects.

The Winter Conference of the Canadian Electrical Association will take place at the Chateau Frontenac, Quebec, Que., January 12-13, 1948.

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E.C.P.D. HOLDS ANNUAL MEETING IN MONTREAL

An annual meeting of the Engineers' Council for Professional Development is something like a full-dress session of what might be termed the Senate of organized engineering in North America. In point of quality of the delegates and importance of the subjects discussed, the Fifteenth Annual Meeting, which was held in Montreal on October 24-25, was in keeping with the established standards. In accepting the invitation of The Engineering Institute of Canada, one of its constituent bodies, ECPD was setting a precedent by holding its annual meeting outside of the United States.

Headed by the president, Colonel L. F. Grant, several out-of-town members of Council and local officers of the Institute were delighted to play hosts to representatives from the other constituent bodies of ECPD, namely, the American Society of Civil Engineers, American Institute of Mining and Metallurgical Engineers, The American Society of Mechanical Engineers, American Institute of Electrical Engineers, The Society for the Promotion of Engineering Education, American Institute of Chemical Engineers, National Council of State Boards of Engineering Examiners.

The meeting was under the chairmanship of Jas. W. Parker, president of the Detroit Edison Co., who was re-elected chairman of ECPD, for a second term. Other officers elected were:

- Vice-Chairman: H. S. Rogers, President Polytechnic Institute of Brooklyn,
- Secretary: A. B. Parsons, Secretary of American Institute of Mining and Metallurgical Engineers,
- Assistant Secretary: S. L. Tyler, American Institute of Chemical Engineers.

On Friday night, October 24th, the visitors were guests of a group of past-presidents of the Institute, at a dinner held at the University Club of Montreal, under the chairmanship of Dr. Arthur Surveyer.

A feature of the annual dinner, which was held at the Mount Royal Hotel, on the 25th, was the presentation of an illuminated inscription to J. P. H. Perry, vice-president of the Turner Construction Company, who was chairman of ECPD in 1938, when admission of The Engineering Institute of Canada in ECPD was first discussed. The parchment was signed by the 18 living past-presidents, the president and the general secretary. Presentation was made by Dr. J. B. Challies, president of the Institute in 1938.

Photo by Bachrach

James W. Parker, Chairman, ECPD.

Ladies Entertained

A group of ladies from the United States, who had accompanied their husbands to the meeting, were entertained, during the two days, by a special committee of the Montreal Branch under the gracious chairmanship of Mrs. J. M. Crawford. Visitors who had stayed over for the Sunday were taken for a motor trip in the Laurentians under the brilliant sun of an exceptionally lenient autumn.

The presence at the meeting of the general secretary of the Institute, Dr. L. Austin Wright, who had been permitted by his doctor to attend some of the functions, was a source of pleasure to officers of the Institute as well as visitors from across the border.

At the fifteenth milestone in its career, The Engineers' Council for Professional Development fully justifies the description which was once given of its efforts as "the first wholly successful co-ordinated co-operative institution in the engineering profession in America.

Institute representatives on ECPD for the current year are as follows:

- C. R. Young, Toronto, Ont.,—ECPD Council and Executive.
- James A. Vance, Woodstock, Ont., — ECPD Council.
- deGaspe Beaubien, Montreal—ECPD Council.
- R. DeL. French, Montreal,—ECPD Committee on Professional Training.
- E. V. Buchanan, London, Ont.,—ECPD Committee on Professional Recognition.
- G. R. Langley, Peterborough, Ont., — ECPD Committee on Student Selection and Guidance.
- L. Austin Wright—ECPD Committee on Information.
- J. W. Brooks, Kingston, Ont., — ECPD Junior Committee on Professional Training.
- J. A. Ouimet, Montreal — ECPD Junior Committee on Professional Training.

It has been ECPD's practice to publish the proceedings of its annual meetings in booklet form and the proceedings of the Fifteenth Annual Meeting are expected to be available in March or April of next year. Dean C. R. Young who has represented the Institute during the past year on ECPD's Council and Executive Committee was the principal speaker at the inaugural luncheon and his address is printed in full, commencing on page 587 of this issue of the *Journal*.

SCENES AT E.C.P.D. SESSIONS (Opposite Page)

Photo **No. 1** shows the speaker at the Annual Banquet, **Dr. Allan R. Cullimore,** of Newark, N.J. **Colonel Grant** is at his left. 2. ECPD Annual Meeting in session. 3. **de Gaspé Beaubien,** Montreal. 4. **Dr. J. B. Challies** of Montreal and **Professor K. L. Holderman** of Pennsylvania State College. **5. Professor W. R. Chedsey** of University of Illinois. **6. Dean C. R. Young** of Toronto University addresses the Opening Luncheon on Friday. Left to right—**Dr. Dugald C. Jackson,** M.I.T., **Dr. Leon Lortie,** Montreal, **Dean Young, President L. F. Grant.** 7. Before dinner at the University Club. Left to right—**Professor Carl J. Eckhardt** of Texas University, **Z. G. Deutsch,** New York, **Dr. Everett S. Lee,** of General Electric, Schenectady, **Professor Chedsey.** 8. The Annual Dinner—**J. B. Challies** (hidden by microphone) presents illuminated address to **J. P. H. Perry** of New York. Seated—**Colonel Grant, Dr. A. H. Cullimore, Prof. Carl J. Eckhardt, Dr. de Gaspé Beaubien, Dean S. C. Hollister** of Cornell University. At left rear—**J. W. Parker,** chairman of ECPD. **9. Dr. Dugald C. Jackson. 10.** At the dinner at the University Club on Friday evening. Left to right—**J. P. H. Perry, J. Colin Kemp,** Montreal, **Dr. D. B. Prentice** of Rose Polytechnic Institute, and **Dr. N. W. Dougherty** of the University of Tennessee. **11. Leon Lortie** (far left) welcomes delegates on behalf of the City of Montreal. Seated, left to right—**Dr. Everett S. Lee, Dean C. R. Young, Lt.-Col. L. F. Grant, J. W. Parker, de Gaspé Beaubien, Dr. W. W. Colpitts,** of the Engineering Foundation, New York.

REGISTRATION IN ENGINEERING AT CANADIAN UNIVERSITIES

University	Year	General Course	Aeronautical Engineering	Agricultural Engineering	Ceramic and Non-metallic Minerals	Chemical Engineering	Civil Engineering	Electrical Engineering	Engineering and Business Administration	Electro-Mechanics	Forest Engineering	Geology and Mineralogy Engineering	Mechanical Engineering	Metallurgical Engineering	Mining Engineering	Engineering Physics	Total
McMaster University.	1st	25															25
Dalhousie University.	1st	61 (27)															61 (27)
	2nd	83 (53)															83 (53)
	3rd	87 (51)															87 (51)
Total		231 (131)															231 (131)
Saint Mary's College, Halifax.	1st	22 (2)															22 (2)
	2nd	11 (1)															11 (1)
	3rd	13 (1)															13 (1)
Total		46 (4)															46 (4)
St. Francis Xavier.	1st	83 (31)															83 (31)
	2nd	78 (37)															78 (37)
	3rd	73 (43)															73 (43)
Total		234 (111)															234 (111)
N.S. Tech. College.	3rd					11 (1)	45 (11)	34 (7)					55 (14)		14 (3)		159 (36)
	4th						18 (6)	28 (5)					33 (14)		5 (1)		84 (26)*
Total						11 (1)	63 (17)	62 (12)					88 (28)		19 (4)		243 (62)
Acadia University.	1st	49 (31)															49 (31)
	2nd	71 (52)															71 (52)
	3rd	38 (29)															38 (29)
Total		158 (112)															158 (112)
Mount Allison University	1st	50 (22)															50 (22)
	2nd	89 (48)															89 (48)
	3rd	77 (42)															77 (42)
Total		216 (112)															216 (112)
University of New Brunswick	1st						39 (20)	40 (20)									79 (40)
	2nd						108 (88)	107 (88)									215 (176)
	3rd						75 (57)	69 (49)									144 (106)
	4th						28 (11)	23 (11)									51 (22)*
Total							250 (176)	239 (168)									489 (344)
Laval University, Quebec	1st	122 (27)															122 (27)
	2nd					13 (2)	15 (1)	26 (3)				2	2 (1)	3	11 (3)		72 (10)
	3rd					9 (1)		16				4		2	6		37 (1)
	4th					12		10				6		3	8		39 ....*
Total		122 (27)				34 (3)	15 (1)	52 (3)				12	2 (1)	8	25 (3)		270 (38)
Ecole Polytechnique.	1st	145 (16)															145 (16)
	2nd	105 (15)															105 (15)
	3rd	60 (3)															60 (3)
	4th					5	32 (2)			29					10 (1)		76 (3)
	5th					4	33			27(1)					6		70 (1)*
Total		310 (34)				9	65 (2)			56(1)					16 (1)		456 (38)
McGill	1st	380 (269)															380 (269)
	2nd					93 (61)	104 (84)	115 (103)					153 (124)	22 (15)	33 (29)	43 (35)	563 (451)
	3rd					58 (34)	82 (50)	67 (47)					117 (77)	12 (8)	10 (9)	12 (8)	358 (233)
	4th					30 (12)	47 (25)	48 (19)					76 (47)	4 (3)	4 (3)	8 (4)	217 (113)*
Total		380 (269)				181(107)	233 (159)	230 (169)					346 (248)	38 (26)	47 (41)	63 (47)	1518(1066)
Queen's University.	1st	334 (165)															334 (165)
	2nd	380 (291)															380 (291)
	3rd					57 (41)	63 (49)	73 (52)				18 (14)	100 (82)	22 (20)	29 (29)	36 (24)	398 (311)
	4th					25 (11)	45 (25)	48 (28)				16 (7)	54 (29)	11 (8)	23 (18)	16 (9)	238 (135)*
Total		714 (456)				82 (52)	108 (74)	121 (80)				34 (21)	154 (111)	33 (28)	52 (47)	52 (33)	1350 (902)
Toronto	1st		53 (41)		8 (7)	158 (95)	179 (120)	211 (161)	65 (38)			48 (29)	246 (192)	33 (28)	52 (37)	65 (44)	1118 (792)
	2nd		72 (53)		10(6)	192(124)	212 (157)	243 (213)	110 (76)			37 (30)	315 (243)	44 (34)	42 (29)	96 (67)	1373(1032)
	3rd		60 (51)		11(11)	173(126)	177 (141)	238 (198)	99 (85)			50 (45)	263 (217)	32 (26)	52 (46)	88 (65)	1243(1011)
	4th		23 (11)		6 (2)	73 (33)	74 (43)	87 (44)	37 (32)			3 (1)	118 (73)	19 (16)	12 (9)	49 (19)	501 (283)*
Total			208(156)		35(26)	596(378)	642 (461)	779 (616)	311(231)			138(105)	942 (725)	128(104)	158(121)	298(195)	4235(3118)
Manitoba	1st	229 (119)															229 (119)
	2nd	307 (213)															307 (213)
	3rd						69 (39)	93 (55)					60 (27)				222 (121)
	4th						37 (16)	42 (11)									79 (27)*
Total		536 (332)					106 (55)	135 (66)					60 (27)				837 (480)
Saskatchewan	1st	233 (52)															233 (52
	2nd	317 (215)															317 (215
	3rd			45(27)	14 (9)	31 (16)	67 (41)	65 (50)				35 (26)	109 (70)			26 (19)	392 (258
	4th			18 (6)	12 (5)	16 (6)	35 (17)	23 (12)				8 (1)	43 (24)			10 (3)	165 (74)*
Total		550 (267)		63(33)	26(14)	47 (22)	102 (58)	88 (62)				43 (27)	152 (94)			36 (22)	1107 (599

*Indicates those graduating in 1948—Total 1,736.

NOTE—The figures shown in brackets indicate, in each case, the number of veterans comprised in the figure immediately preceding.

University	Year	General Course	Aeronautical Engineering	Agricultural Engineering	Ceramic and Non-metallic Minerals	Chemical Engineering	Civil Engineering	Electrical Engineering	Engineering and Business Administration	Electro-Mechanics	Forest Engineering	Geology and Mineralogy Engineering	Mechanical Engineering	Metallurgical Engineering	Mining Engineering	Engineering Physics	Total
Alberta........	1st	232 (140)	....	..	..	.....	......	......	....	..	...	....	......	....	....	....	232 (140)
	2nd	......	....	..	..	69 (53)	106 (81)	133 (101)	....	..	...	....	......	....	47 (40)	....	355 (275)
	3rd	......	....	..	..	67 (51)	64 (51)	62 (53)	....	..	...	....	......	....	58 (50)	10 (7)	261 (212)
	4th	......	....	..	..	23 (9)	40 (17)	28 (15)	....	..	...	....	......	....	14 (7)	6 (4)	111 (52)*
Total.......	....	232 (140)	....	..	..	159(113)	210 (149)	223 (169)	....	..	...	....	......	....	119 (97)	16 (11)	959 (679)
British Columbia..	1st	478 (266)	....	..	..	.....	......	......	....	..	35(22)	....	......	....	....	....	513 (288)
	2nd	660 (465)	....	..	..	.....	......	......	....	..	50(43)	....	......	....	....	....	710 (508)
	3rd	......	....	13 (9)	..	50 (29)	70 (44)	71 (44)	....	..	26(17)	20 (11)	92 (49)	20 (15)	17 (9)	17 (9)	396 (236)
	4th	......	....	1 (0)	..	25 (5)	31 (13)	32 (5)	....	..	7 (4)	16 (7)	41 (11)	12 (5)	7 (4)	9 (1)	181 (55)*
Total.......	....	1138 (731)	....	14 (9)	..	75 (34)	101 (57)	103 (49)	....	..	118(86)	36 (18)	133 (60)	32 (20)	24 (13)	26 (10)	1800(1087)
Grand Total	.....	4867(2726)	208(156)	77(42)	61(40)	1194(710)	1895(1209)	2032(1394)	311(231)	56(1)	118(86)	263(171)	1877(1294)	239(178)	460(327)	491(318)	14149(8883)

*Indicates those graduating in 1948—Total 1,736.

NOTE—The figures shown in brackets indicate, in each case, the number of veterans comprised in the figure immediately preceding.

The foregoing table continues a *Journal* feature of proven usefulness. In checking the figures against those of the past two years, engineers—and there are many—who have been concerned over the large numbers of students enrolled in engineering may find some measure of reassurance.

Primarily, there seems to be an indication that, with a few exceptions, the peak of veteran enrolment, has passed. The same trend is evident, although to a lesser degree, for the non-veterans. There is also gratifying evidence that standards are not being relaxed since the usual diminution of the numbers as they progress from year to year is evident and the veterans, in spite of their demonstrated serious attitudes to their courses are not notably exceptional to the normal failure rate.

The Universities are to be congratulated once again on their accomplishments in taking care of such unprecedented numbers of students—particularly the engineering faculties, because the veterans have turned to this field in undreamed-of numbers. We believe the veterans themselves are to be congratulated upon a wise choice because, whether or not they follow engineering as a career they will have received a training which will be of value in any field of endeavour. The *Journal,* in fact, would like to re-state an argument which we believe to be sound. With the large numbers of engineers who will graduate in the next few years it may well happen that there will not be engineering jobs available in sufficient numbers. We are convinced, however, that the engineering training is a superior qualification in almost any line of endeavour and that an engineer should not hesitate to give his training a trial in other fields if at any time he finds that strict engineering work does not afford complete satisfaction to his ambitions. Numerous examples of the truth of this thesis can be found in Canada today and it may go a long way toward solving a possible employment crisis if large numbers of engineers will direct their energies to other fields if engineering does not entirely suit their temperaments. The degree and the training will stand an engineer in excellent stead in other activities and there need never be any suspicion that the years in College were not profitable.

PROVINCE OF QUEBEC OFFERS PRIZES FOR SCIENTIFIC PAPERS

Judging from the numbers of papers submitted, it seems possible that the literary and scientific contests of the Province of Quebec are not sufficiently publicized. The *Journal* therefore directs the attention of those of its readers who might qualify to the following extracts from Chapter 138 of the Revised Statutes of Quebec (1925).

Three competitions are instituted concurrently each year for the following prizes: one prize in literature, one prize in science and one prize in moral and political science.

The amount provided for each of the three prizes is fourteen hundred dollars ($1,400), divided as follows: first prize: eight hundred dollars ($800); second prize: four hundred dollars ($400); third prize: two hundred dollars ($200). If two competitors merit the first prize, each will receive six hundred dollars ($600), and consequently there will be no second prize. No prize will be awarded, at the discretion of the jury, if no work is presented or if the works presented are worthless.

Every Canadian subject, whether by birth or naturalization, provided he has resided in the Province of Quebec for three years previous to the date of the closing of the competition, may participate in each of the three competitions, save the restrictions hereinafter stated. Students of the Province of Quebec studying outside the Province of Quebec, and Canadians who have left the Province of Quebec to fulfil, elsewhere, some public office in the service of the Province of Quebec or of the Government of Canada are also eligible.

However, any author who, in a competition instituted by the Government of the Province of Quebec, has won, alone or *ex aequo*, a first prize, is eliminated from competitions of the section wherein he won the prize, for the eleven following years.

Likewise, the winner of a first prize in the competitions held under the old regulations for literary and scientific prizes, cannot, for a period of eleven years from the date of their laureation, be admitted to compete in the same sections.

The common work of two or more authors is admitted to one or the other of the sections, on the same basis as the work of one single author.

The prizes are awarded to French or English language papers according to a cycle set forth in the Statutes. Complete details may be obtained from the Provincial Secretary of the Province of Quebec in Quebec City.

SEMINAR ON STANDARDIZATION

For the benefit of companies and individuals having problems concerning the organization of standardization work or the technique of writing standard specifications, a private seminar is being offered by Dr. John Gaillard, mechanical engineer on the staff of the American Standards Association, and lecturer on industrial standardization at Columbia University. This five-day seminar will be held Monday through Friday, January 26 to 30, 1948, in Room 503, Engineering Societies Building, 29 West 39th Street, New York City. Those interested in registration are requested to write Dr. Gaillard at his home address, 400 West 118th Street, New York 27, N.Y.

The following are some of the subjects to be treated:

- Development of various types of technical and managerial standards in human society. Increasing significance of standards with evolution of industry to modern mass production methods.
- Classification of standards.
- Nominal values, permissible deviations, limits and tolerances.
- The general problem of quality control.
- Review of American, British and international (ISA) tolerance systems.
- Four levels of industrial standardization: company, trade, national and international.
- Place of company standards department in management picture.
- Content, form, arrangement and wording of specifications.

INTERESTING TEST OF TIMBER STRUCTURE

A test of considerable interest to construction engineers and lumbermen in all parts of Canada is being conducted at Ottawa by the Forests Products Laboratories of the Department of Mines and Resources.

Using a process of glue lamination, Laboratories engineers have built a wooden arch with a 47-foot span and a 21-foot rise, and are at present subjecting it to a total design load of 27,920 pounds plus an overload of 20,680 pounds. It is planned to study the behaviour of the arch, under overload, for several months.

The arch is constructed throughout of layers of white spruce glued together with a casein glue under nailed pressure. It was designed as a three-hinged arch and constructed in two sections which were connected on erection by a metal sleeve. The arch is intended to serve as the roof support of a proposed building with an inside width of 47 feet, 6 inches, and a maximum height, to underside of roof, of approximately 21 feet.

Pointing out that large-size timbers are becoming increasingly difficult to obtain, particularly in Eastern Canada, T. A. McElhanney, Superintendent of the Laboratories, said that through the process of lamination small timbers can be glued together to make large ones with sufficient strength to withstand heavy loads.

It was explained that lamination could be used to good advantage in the construction of arches for churches, drill halls, auditoriums, skating rinks and industrial buildings in which a clear view is essential, and that it could also be employed in building barns.

The arch has been loaded with eight boxes of sand supported by thirty-two steel rods uniformly spaced along the length. It is now carrying a load, including the weight of boxes and attachments, but excluding the weight of the arch itself, of 48,600 pounds.

The load represents the following:

Dead load of roof, approximately 14 pounds per sq. ft.
Snow load on roof, 40 pounds per sq. ft.
Overload, 40 pounds per sq. ft.

It is to be noted that the deflection of the crown hinge, to date, is less than three inches.

ADDRESSES WANTED

In order that our membership records may be as complete as possible it would be greatly appreciated if any available information regarding the whereabouts of the following members could be sent to us with the least possible delay. The date of our last active communication with these members is indicated in brackets.

MEMBERS

BALL, Walter Lance (Apr., 1942)
BERGER, Bernard Avrom (Nov., 1947)
BUCK, Richard S., (Aug., 1947)
CLEATON, R. Ewart (Nov., 1947)
COCKSHUTT, Clarence Foster (Feb., 1942)
COLE, Albert Liddiard (Apr., 1947)
DAVIDSON Charles Fraser (Sept., 1947)
DEMPSEY, Francis Craig (June, 1946)
DOHERTY, Charles Alexander (Aug., 1940)
DUNLAP, Clarence R., (Dec., 1942)
DUNLOP, Duthie MacIntosh (Feb., 1947)
ERICKSON, Peter O. M. (Feb., 1947)
EWART, George R. (Jan., 1942)
FORTIN, Jean Julien (Nov., 1946)
FOWLER, Charles E. (Sept., 1939)
FRY, Edmund Botterell (May, 1945)
GAVAN, John Leslie (Apr., 1947)
GENET, Brigadier John Ernest (July, 1943)
GREGOR, Michael (Apr., 1941)
GREY, Noel William (Apr., 1945)
HALE, Frederick John (Feb., 1946)
HAVENS, Verne Leroy (July, 1941)
HIGGINS, F. C. (Aug., 1943)
IRETON, Joseph Maurice (Mar., 1946)
JENSSEN, Laurence Nicholas (May, 1940)
KINDERSLEY, Robert E. G. (Apr., 1942)
LAPEYRE, Jean (Feb., 1946)
LAURIE, William Little (Oct., 1940)
McCLINTOCK, George Arthur (Apr., 1941)
McINTYRE, Jacob Spence (Sept., 1946)
MacKENZIE, D. Campbell (Apr., 1945)
MAGNANT, Daniel Armand (Feb., 1947)
MASSEY, Denton (Jan., 1943)
MEADE, John Campbell (June, 1943)
MILES, Harold R. (July, 1943)
MILLER, William Miles (Oct., 1940)
PALMER, Roland Foster (Nov., 1944)
PEERS, Arthur Francis (Sept., 1942)
REID, Fraser Daniel (Jan., 1945)
RICHARDS, Edward Green (Apr., 1945)
ROSS, Donald Grant (Nov., 1947)
ROSS, Hugh Gordon (Nov., 1946)
RUST, Henry P. (June, 1941)
SCOTT, Ainsworth David (Nov., 1947)
STEIN, Charles R. S. (Apr., 1943)
SUTHERLAND, J. R. S. (May, 1941)
TAIT, Isaac Joseph (Sept., 1947)
TOOKER, Guy L. (Apr., 1947)

JUNIORS

AHEARN, William Jefferson (Nov., 1947)
BAILEY, John Calvin (Apr., 1947)
BATES, Arthur John Clark (Apr., 1947)
BEATTY, James Edward (Jan., 1940)
BELYEA, James L. (Nov., 1947)
BLAINE, Donald Smith (Mar., 1941)
BRAZIER, Jack Henry (Nov., 1946)
BROWN, Donald Whidder (Feb., 1947)
BURROWS, James Louis (July, 1943)
CAMERON, Curtiss B. (Nov., 1940)
CHARYK, Joseph Vincent (Nov., 1946)
COLE, Robert Arnold (Mar., 1947)
COLGAN, Patrick Joseph (Feb., 1941)
COLLINGWOOD, John C. (Mar., 1941)
CONLIN, Gerard Herbert (Nov., 1942)
COPPICK, Sydney (Dec., 1941)
CRANDALL, Seymour Arnold (Aug., 1944)
CROSSLEY, Robert John (Nov., 1947)
CUMMING, John William (Apr., 1947)
DERNIER, Herbert Clarence (Sept., 1940)
DEWIS, Marshall Woodworth (Mar., 1942)
DOLAN, M. A. (May, 1940)
DOWELL, Eugene Harris (Apr., 1947)
DUMONT, Gilbert (June, 1947)
FISHER, Earl Holden (Nov., 1947)
FORBES, Cyril Robert (July, 1945)
FORRESTER, Robert Andrew (Dec., 1942)
FOSTER, Ian McLeod (July, 1945)
FRASER, William Mitchell (Nov., 1946)
GARLAND, Hedley Robert (July, 1946)
GODBOUT, Adolphe Gerard (Mar., 1941)
GORDON, Ian Percy (Nov., 1947)
GREGORY, Arthur Herbert (June, 1946)
GUSEN, Aaron (May, 1945)
HAGER, Fritz (June, 1946)
HART, Herbert French (Oct., 1943)
HEPPNER, Selwyn Alexander (Jan., 1942)
HORTON, Graydon Thring (June, 1946)
JOSNSON, F. Paul (May, 1942)
JUNKIN, Bruce Frederick (Nov., 1946)
LANE, Robert Campbell (June, 1946)
LANGENEK, Frederick (Apr., 1947)
LEEPER, Robert Patrick (June, 1945)
LEON, Clifford Ernest (Sept., 1946)
McCALLUM, John Francis (Feb., 1947)
McDIARMAID, Lorne Grant (Apr., 1947)
MacINNES, T. R. L. Malcom (June, 1947)
MacKAY, Donald Wilson (July, 1940)
McLEAN, Donald Fraser (Feb., 1947)
McLEAN, Gordon M. (Nov., 1940)
McLEOD, Donald Morley (Apr., 1947)
McNIVEN, Hugh Donald (Nov., 1947)
MABLE, Wilfred H. (June, 1946)
MAGEE, E. D. B. (Nov., 1940)
MANN, Neville Whitney Davis (Oct., 1943)
MASON, Harvey Libby King (Feb., 1940)
MENARD, Jean (Nov., 1947)
MERCER, George (Jan., 1944)
MIALL, Edward (Apr., 1947)
MOORE, Arthur Donald (Apr., 1947)
ORR, James Campbell (Feb., 1947)
PALMER, Kenneth Winfield (Oct., 1941)
PAYAN, C. F. (Sept., 1944)
PIMENOFF, Vladimir John (Nov., 1947)
POTTRUFF, Walter Allan (Nov., 1946)
REIKIE, W. Thorpe T. (June, 1941)
ROBINSON, A. H. (Sept., 1942)
ROLLEFSON, Martin Orrel (Aug., 1942)
SANDERS, George Ostrom (Apr., 1946)
SARCHUK, Leon A. (Nov., 1946)
SCHNYDER, Max (Feb., 1941)
SCOTT, William Bruce (Apr., 1947)
SENTANCE, Richard Clarence (Apr., 1947)
SINCLAIR, Donald Alfred (Nov., 1947)
SMITH, Willard A. (Feb., 1941)
SOKOLOSKI, Steve (Sept., 1943)
STAPLETON, Michael J. (Mar., 1947)
STEELE, Owen Stevenson (Apr., 1947)
STEWART, Murray Douglas (Nov., 1942)
TAYLOR, Thomas A. I. C. (Apr., 1943)
TERNAN, James B. (Oct., 1942)
THOMPSTONE, Robert Edward (Oct., 1941)
THORNE, H. L. (Sept., 1940)
TODD, Henry (Apr., 1941)
TREMBLAY, Jules (Apr., 1947)
VENABLES, William Norman (Jan., 1941)
WALDRON, John Ross (Apr., 1947)
WARD, Walter George (Sept., 1942)
WHILLIANS, Thomas George Douglas (Nov., 1947)
WILLIAMS, James Luther (Nov., 1947)
WILLS, Nicholas James (Nov., 1940)
WINN, James (Aug., 1941)
YEE, Thomas Marion (June, 1943)

STUDENTS

ARNSDORF, Hans (Feb., 1944)
BANDIERA, Leo Joseph (Nov., 1943)
BERNARDI, Aldo (Feb., 1946)
BERNICK, Henry (June, 1947)
BERTRAND, Gaston (Mar., 1940)
BOYLE, Lionel (Feb., 1944)
BROCKHURST, Donald Norman (Nov., 1947)
CALDER, John (Jan., 1941)
CHENIVESSE, Emile (Dec., 1943)
CLARK, Chester Graham (Apr., 1946)
COLDITZ, Herbert Ware (Dec., 1943)
CORELLI, Charles Rae (Nov., 1947)
COTE, Jean-Marie (Apr., 1947)
CUMMINE, William Sturgis (Oct., 1945)
DALTON, John Terrence (Nov., 1947)

DANYLUK, Daniel (Aug., 1947)
DARLING, Ralph Gifford (Nov., 1946)
DICK, William (Jan., 1947)
DIXON, Frederick (July, 1947)
ELLIS, Gordon McLean (Apr., 1947)
ELLIS, William Edward (Aug., 1947)
FLAY, Alfred David (Oct., 1942)
GAGNON, Adrien (July, 1945)
GALBRAITH, John Douglas (June, 1946)
GOW, William M. G. (Sept., 1947)
HOLLIS, Edward Kimball (Apr., 1947)
HURD, William Henry (July, 1947)
JONES, Edward Donald (Dec., 1946)
KELLY, Frank Leonard (Nov., 1947)
KING, Geoffrey (Nov., 1947)
KING, John Shirley Lowe (July, 1943)
KUZYK, William John (Apr., 1946)
KYLES, James Stirling (Nov., 1947)
LAMARCHE, Patrice Luc (Nov., 1946)
LOTTS, Gordon Richard (Sept., 1947)
LOW, Donald Richard (Aug., 1947)
LOWE, Howard Thomas (Oct., 1941)
McCAFFERY, Thomas Joseph (Sept., 1947)
McCLELLAND, James Iver (Nov., 1947)
MacDONALD, William Earle (Feb., 1946)
MacGREGOR, William Robert (Jan., 1947)
MACKEY, Keith Barker (Mar., 1945)
MACKIN, Gerard Francis (Apr., 1947)
MAGUIRE, Robert Adam (Apr., 1946)
MAIN, Allen (Nov., 1947)
MARSHALL, James Andrew (Nov., 1947)
MATHESON, John Gordon (Nov., 1946)
MERCER, William Edward (Aug., 1943)
MILLER, Justin Ormond (Nov., 1942)
MUDGE, Albert Edward (Sept., 1947)
NICOLLE, Phillip Clement (July, 1947)
OLIVER, Harold Evans (Sept., 1946)
ORKIN, Richard Cottingham (Apr., 1947)
OXLEY, Loren Arther (Dec., 1943)
PARE, Yvon (Feb., 1947)
PEARCE, Leo Alfred (Nov., 1947)
PROVIAS, Peter J. (Apr., 1947)
PURDIE, William McLeod (Nov., 1947)
RIOUX, Jean Gaston (Apr., 1947)
ROGERS, Robert G. (Mar., 1942)
ROSSITER, Vincent P. (Nov., 1947)
SHORE, Robert Ellis (Apr., 1947)
STERNE, Francis Eddy (Apr., 1947)
THOMAS, George D. (Nov., 1947)
THOMPSON, Ronald Matheson (June, 1947)
TREVIRANUS, Klaus Stewart (Nov., 1947)
TROUT, Ross Gregory (Nov., 1942)
WALES, Donn (May, 1946)
WELCH, John Kenneth (Nov., 1945)
WESTMAN, Robert Allan (Nov., 1947)
WILEY, Robert B. (Nov., 1947)
WILLIAMSON, John Richard (Apr., 1947)

AFFILIATES

FORSTER, Duncan Hunter (Nov., 1946)
GOLDENSTEIN, Abraham (Oct., 1942)
KEANE, Edward Joseph (Feb., 1947)
MacDONALD, Martin John (June, 1942)
WILSON, Alexander (Nov., 1947)

MEETING OF COUNCIL

Minutes of a regional meeting of the Council of the Institute held at the Nova Scotian Hotel, Halifax, Nova Scotia, on Saturday, October 11th, 1947, convening at ten o'clock A. M.

Present: President L. F. Grant (Kingston) in the chair; Past President J. B. Hayes (Halifax); Vice-President C. M. Anson (Sydney); Councillors G. M. Brown (Saint John—representing the Association of Professional Engineers of New Brunswick), A. E. Cameron (Halifax—representing the Association of Professional Engineers of Nova Scotia), G. J. Currie (Halifax), C. D. McAllister (Saint John), S. C. Mifflen (Sydney), L. E. Mitchell (Halifax), J. B. Stirling (Montreal), and W. D. Laird, Assistant General Secretary.

There were also present by invitation—Past-Councillors K. L. Dawson, P. A. Lovett, I. P. Macnab and C. H. Wright, all of Halifax; A. E. Flynn (Halifax), President of the Association of Professional Engineers of Nova Scotia, and a past-councillor of the Institute; J. D. Kline, registrar of the Association and secretary-treasurer of the Halifax Branch; G. A. Gaherty, chairman of the Institute's Committee on Prairie Water Problems; E. C. O'Leary, chairman, C. D. Martin, immediate past-chairman, and Max L. Baker, C. A. MacNearney, W. C. Risley and E. C. Thomas, members of the executive of the Halifax Branch.

In opening the meeting the president commented on the fact that this was the first time he had had the honour of presiding at a Council meeting outside of Montreal. He expressed his appreciation of the hospitality and kindnesses extended by the Cape Breton and Halifax branches. Following the usual custom, the president asked each person present to introduce himself to the meeting.

The minutes of the meeting held on September 20th, 1947, were taken as read and approved.

Business Arising From the Minutes

Canadian Construction Association—Mr. Stirling, chairman of the Institute's Committee on Professional Interests, brought before Council, on behalf of this committee, the matter of the Canadian Construction Association's request for endorsement of their petition to the Dominion and provincial governments concerning deferment of public projects at the present time and also of a creation of a shelf of public projects to be used when employment conditions throughout the country might warrant it.

He pointed out that at the present time the construction industry was working at its utmost capacity and that employment in the engineering profession was at a high level. Any further introduction of public works into the market at the present moment would appear to be unwise and, in fact, the Dominion government had acknowledged that only those vitally necessary should be started at the present time. The Association's attitude was that as much work as possible be deferred until the advent of a recession in business when such works would be needed to give employment not only to the construction industry but to the engineering and architectural professions. It was not enough, he continued, to rely on deferred works for a reasonable volume of employment in the construction industry. It had been in the depression years of 1931 and 1932 particularly, that when employment projects in construction were required, plans were not readily available and in certain projects, years were required to bring such plans to completion. It was prudent, therefore, to advance the idea of future planning at once.

A canvass of the various departments of Dominion and provincial governments had revealed the fact that future planning had not been actively done and it was the purpose of the Canadian Construction Association to enlist the support of the Engineering

Institute of Canada, the Royal Architectural Institute of Canada and other organizations who were vitally interested in the subject.

As the Engineering Institute had already endorsed the action of the Canadian Construction Association there was no further action requested at the present time but Council was advised by Mr. Stirling that it would be kept informed of any development on the subject.

Dr. Cameron discussed the subject at length and felt that it was going to be a difficult thing to bring the plans to the tendering stage as plans were rarely complete before alterations began to appear. He referred to several projects which were being actively discussed in Nova Scotia at the present time, such as the Canso Causeway, the Halifax-Dartmouth bridge, and the Chignecto Canal, as well as certain additional buildings for educational institutions. Dr. Cameron foresaw difficulty in bringing these plans to the stage of calling for tenders. He pointed out that there were certain stages through which plans had to go, namely, expropriation of land, legal difficulties to be straightened out, as well as investigation of soil conditions, etc., all of which take time but, generally speaking, he favoured an immediate start on such activities on the basis that it would cut down the time to be lost in the final preparation of the plans.

Mr. Flitton asked if there was a dearth of planning staff, that is, engineers and architects, in government circles such as existed in private industry and was informed that that was very much the case; practically every government, Dominion and provincial, had complained that they were having difficulty in securing sufficient staffs to proceed with the planning of public projects on a proper scale.

Mr. Mifflen suggested that the various governments might do well to employ private engineering and architectural firms to assist them in carrying out the work as they had done in the past.

The president offered the suggestion that the members of the Engineering Institute of Canada could do a great deal to promote thinking along the lines of the committee's interim report by offering their services in a broad way in matters of policy and by not being too backward about expressing their individual views on the merit or otherwise of public projects when they came up for discussion.

Community Planning Conference—The president referred to the Conference on Community Planning which had been held in Montreal on October 2nd, 3rd and 4th, under the joint auspices of the Community Planning Association of Canada and the Engineering Institute, and he asked Past-Councillor Macnab, who had attended all the meetings, if he would present a brief report on the proceedings.

Although he had not prepared a formal report, Mr. Macnab was very glad to give his impressions of the meeting. He was very glad that the Engineering Institute had been able to take such an active part. Mr. Macnab had attended the meeting, not as an engineer, but as a member of the Nova Scotia branch of the Community Planning Association of Canada. The meeting had convinced him of two things—(1) the great necessity of more careful planning of our communities in the future, and (2) the part that the engineer must of necessity play in that planning.

The discussions had brought out that planning is not only the work of the engineer but that there are many phases to it which can be carried out successfully only by the co-operation of all those who are interested, including governmental and municipal authorities, social services of all kinds, engineers and architects.

The meeting lasted for three days, the first day being taken up entirely by engineering subjects. On the afternoon of the second day, instead of taking a bus trip around the city, a large number of engineers got together and discussed the part that engineers and the Engineering Institute in particular, should take in promoting community planning. The minutes of that meeting have been sent to the Institute's Committee on Community Planning and a report with recommendations will be circulated in due course.

The speakers at the various sessions had included well known authorities on the subject from England, the United States and from Canada, all of whom emphasized the tremendous scope of the problem and how essential community planning is to decent living. One thing that had impressed Mr. Macnab was the ultimate economy that can accrue from proper planning.

The meetings were well attended, representatives being present from every province in Canada. The discussions had been good and had lasted each day from nine in the morning until ten o'clock at night. In Mr. Macnab's opinion, it had been a most satisfactory meeting and he thought the Engineering Institute had taken a very wise step in associating itself with this work. He strongly recommended to Council that the work be carried on.

Civil Service Commission Qualifications — The president reminded Council that up until recently the Civil Service Commission regulations had included a clause which stipulated membership in the Engineering Institute of Canada as one of the qualifications for an engineering position in the Civil Service. That requirement had been removed and an attempt was being made to have it replaced. At the last meeting of Council the matter had been referred to Mr. N. B. MacRostie, chairman of the Institute's Committee on the Engineer in the Civil Service, but no further report had yet been received. This was noted.

Remuneration of Engineers in the Services—The president reminded Council that the Institute's support had been requested in securing the "responsibility allowance" for engineers in the armed services, which at the present time is given only to doctors and dentists. This matter had the Institute's support and was now receiving consideration. It would be taken up with the proper authorities as soon as possible but at the moment there was nothing further to report.

Pensions for the Staff — At the last meeting of Council a pensions plan for the Institute staff(submitted by the Finance Committee, had received the unanimous approval of those members present at the meeting, but it had been decided to submit a letter ballot to all councillors for approval of this plan.

The result of this ballot was reported as 39 in favor and none against and accordingly, the pension plan for the Institute staff, as submitted by the Finance Committee, was adopted unanimously. On the motion of Vice-President Anson, seconded by Councillor G. J. Currie, it was unanimously resolved that the president, the chairman of the Finance Committee, and the general secretary, or any two of them, be authorized to sign the necessary contracts with the Standard Life Assurance Company of Canada, and that the general secretary or the assistant general secretary be authorized to sign membership and discharge certificates for the plan.

Possible Overcrowding of the Engineering Profession—The president read the letter from the Moncton Branch and said that he had, by direction of Council at the September meeting, referred it to Dr. Langley, chairman of the Committee on the Training and Welfare of the Young Engineer, and that his reply would be presented to Council when received. He had also written the Moncton Branch explaining the views expressed at the September meeting. He asked Dr. Flynn what he thought of the suggestion of putting the matter up to the universities.

Dr. Flynn thought the universities would be glad of some direction from the profession.

Mr. C. H. Wright thought that if engineers took a greater interest in public affairs, many of them would be sought for in positions outside of engineering.

Vice-President Anson thought that there would be a problem, but not to the extent visualized by Moncton. He said that his industry had not been getting as many young engineers in the past few years as were needed and that the slack must be made up.

Mr. Gaherty said that in the electrical industry he expected that a much greater proportion of engineers as compared with technicians would be employed than was the case in the past.

Mr. Hayes said that the situation was not parallel to that of the medical profession, in which every student expected to be a doctor or a surgeon. He thought it would be wrong to suppress the opportunities for young Canadians to study engineering.

Mr. Mifflen said that he would like to associate himself with the remarks made by Vice-President Anson, but that he had some sympathy with the point of view expressed by Moncton.

Mr. Gaherty stressed the desirability of training students for positions as foremen and plant superintendents. He said that a man with engineering training is away ahead of the man who comes up with practical training only, and that there were not enough engineers in the practical operating jobs.

The president said that he would discuss the matter with the Moncton Branch on the occasion of his visit there.

Institute Representation on ECPD—The president reported that Mr. Vance had accepted nomination as the Institute's representative on ECPD to replace Dr. K. M. Cameron. At Council's request the president had communicated with Dean Young to see if he would reconsider his decision to resign as one of the Institute's representatives, but Dean Young had indicated that he could not continue. At his suggestion, a member of the Institute in Montreal had been approached and it was hoped that an acceptance of nomination would be received within a few days, so that the appointment might be made at the forthcoming annual meeting.

C.I.G.R.E.—The president reported that in accordance with the decision of Council at the last meeting, Mr. E. D. Gray-Donald, of the Quebec Power Company, had been asked to represent the Institute on the Canadian National Committee of C.I.G.R.E. (International Conference of Large Electrical Systems). The president had received a telegram from Mr. Gray-Donald advising that as soon as he had been able to consult his company he would let the Institute have a definite answer.

List of Nominees for Officers—The nomination for president for the year 1948 was presented and approved unanimously, subject to formal confirmation from the chairman of the Nominating Committee (which has since been received). Nominations for councillors from the Cornwall and Quebec branches were also received and approved unanimously.

Accordingly, the following nominations have been added to the list of nominees as approved by Council at the last meeting:

President: J. N. Finlayson, Vancouver
Councillors:
Cornwall Branch: Drummond Giles
Quebec Branch: E. D. Gray-Donald

Appointments to Council: The appointment of Dr. A. E. Cameron as the representative of the Association of Professional Engineers of Nova Scotia on the Institute Council to replace the late S. W. Gray, was approved unanimously.

On the recommendation of the Cornwall Branch, it was unanimously resolved that Mr. Drummond Giles be appointed councillor to serve until the next annual election to replace the late Baron Boris deHueck.

Conservation of Canada's Natural Resources—At the last meeting of Council a suggestion had been received from Mr. Fraser Keith that the Institute, in following out one of its objectives, should take some action to further the development and conservation of Canada's natural resources, and at Council's request Mr. Keith had submitted a letter giving details of his proposal.

The president felt that this was a most important question and he asked for an expression of opinion from members present.

In Mr. Macnab's opinion this subject was of vital interest to every Canadian and he suggested that any committee set up by the Institute should have representatives on it from all parts of the Dominion It might be desirable to have a series of committees in the various geographical areas, reporting to a central committee.

Dr. Cameron pointed out that already there are in existence a number of committees and research councils dealing with specific problems of conservation and he thought that anything undertaken by the Institute should be in co-operation with these other bodies. The problem had to be studied from a technical point of view and also with a view to propaganda in order to get the members of the Institute behind the idea of conservation and protection.

Mr. Hayes was not in favour of setting up a central committee or a series of committees. He believed the Institute could make the greatest contibution by emphasizing to its membership the importance of conservation.

The president agreed with Mr. Hayes. He was afraid that an Institute committee on a part time basis could not accomplish very much from a technical point of view. He thought it was a matter of educating the Institute members. To do this it might be possible for the Institute to have representatives on these various conservation committees and then circulate their views and recommendations to the Institute membership through *The Engineering Journal.*

Following a lengthy discussion, on the motion of Mr. Mitchell, seconded by Mr. Currie, it was unanimously resolved that a committee be appointed to explore the situation and advise Council as to the action it should take in order to assist in this important work of conservation and protection of Canada's natural resouces. At the president's request, Dr. A. E. Cameron accepted the chairmanship of this committee.

REPORT OF FINANCE COMMITTEE

Financial Statement: It was noted that the financial statement to the end of September had been examined and approved.

Renewal of Tender for the Journal: It was noted that the Finance Committee has authorized the acceptance of a new tender for the printing of *The Engineering Journal* which represented an approximate increase of forty per cent in the printing costs

Proposal for Journal Advertising: It was reported that the Finance Committee had authorized the termination of the existing contract for *Journal* advertising and the signing of a new contract with Mr. E. J. Blandford, of Montreal, whereby he would assume the position of Publications Manager for *The Engineering Journal.* The action of the Finance Committee was approved unanimously.

Maritime Professional Meeting: It was noted that approval of the dates of September 8th, 9th and 10th, 1948, for a maritime professional meeting to be held in St. Andrews, New Brunswick, had been received from all the maritime branches. It would therefore now be in order to confirm the dates with the C.P.R. hotel department and proceed with the preliminary arrangements.

Annual Meeting 1948: With regard to the next annual meeting of the Institute, to be held in Banff in June 1948, it was reported that inquiries were being made as to whether or not special rates could be obtained for transportation either by train, by bus, or by plane.

Following some discussion, it was agreed that inquiries should be made to ascertain whether or not a better rate than $15.00 a day could be obtained from the Banff Springs Hotel. It was also agreed to explore the possibilities of accommodation at some of the smaller hotels or in the bungalow cabins.

It was suggested that the central and eastern branches should start canvassing their members in an effort to get a good attendance from these branches at the western annual meeting.

Suggested Council Meeting in Cape Beton: Vice-President Anson had been asked by the Cape Breton Branch to place before Council the desirability of holding a regional meeting of Council in Sydney some time in the not too distant future, having in mind that such a meeting would stimulate interest in Institute affairs. He had much pleasure in extending the invitation to Council.

Next Meeting of Council: It was noted that the next meeting of Council would be held in Quebec City on Saturday, November 29th, following the banquet on the night of the 28th, celebrating the fortieth anniversary of the branch. The president expressed the hope that members from other provinces would be able to attend those celebrations.

The Council rose at twelve forty-five P.M.

W. D. Laird,
Assistant General Secretary.

ERRATUM

ELECTIONS AND TRANSFERS

In the elections and transfers recorded on page 487 of the October *Journal* the name of **Gerald Gerhard Fisch** was included as a member elected under the terms of the co-operative agreement with the Saskatchewan Association. This name was included in error as Mr. Fisch's application for membership in the Institute has not yet been submitted to Council, and he is not a member of the Saskatchewan Association.

Personals

News of the Personal Activities of members of the Institute

Lesslie R. Thomson, M.E.I.C., has been awarded the Medal of Freedom, with Gold Palm, by the government of the United States. The accompanying citation read as follows: "Mr. Lesslie R. Thomson performed exceptionally meritorious service to the United States in accomplishments involving great responsibility and scientific knowledge in connection with the development of the atomic bomb. As special liaison officer for the Government of Canada from 1942 to 1945 he closely joined the common interests of the United States and Canada. Mr. Thompson's sound judgment, initiative and resourcefulness and his unselfish and unswerving devotion to duty contributed significantly to the success of the atomic bomb project".

Dr. Alan E. Cameron, M.E.I.C., president of Nova Scotia Technical College, Halifax, N.S., will represent the Association of Professional Engineers of Nova Scotia on the Council of the Institute. He is a Past-president of the Nova Scotia Association, of the Nova Scotia Mining Society, and of the Canadian Institute of Mining and Metallurgy.

A. J. Bennett, M.E.I.C., has been appointed Toronto District Manager by English Electric Company of Canada Limited, St. Catharines, Ont. Since joining the company almost 19 years ago, Mr. Bennett has had extensive sales experience in Toronto, Montreal and Kirkland Lake offices. Since 1940 he has been engaged in production, his most recent appointment being plant superintendent.

H. R. Fee, M.E.I.C., is chairman of the Saguenay Branch of the Institute for the 1947-48 season. He is from Killam, Alberta, a graduate in electrical engineering from the University of Alberta, in the class of 1934. He was engaged for three years after graduation in private contracting work. From 1937 to 1941 he was with International Nickel Company of Canada Limited, and in 1941 he went to the Aluminum Company of Canada Limited. He was first employed in the test department of the Saguenay Power Company at Arvida and became plant engineer. He was appointed system operating engineer in 1942. He is now general superintendent of the Saguenay Power Company Limited at Isle Maligne, Que.

John Donnelly, M.E.I.C., electrical superintendent for Algoma Steel Corporation Limited, Sault Ste. Marie, Ont., retired in November after 37 years service with the company. He expects to start in business in Sault Ste. Marie, Ont., as a manufacturer's agent for electrical and mechanical equipment.

J. A. Murray, M.E.I.C., is sales manager for James B. Carter Limited, Winnipeg, Man. He was previously with Northern Electric Company Limited in Montreal. He was a manufacturing engineer in the Electronics Division.

J. F. Bridge, M.E.I.C., is now with the Morton Salt Company, Manistee, Michigan. Mr. Bridge was chairman of the Border Cities Branch of the Institute in 1940, and had been its secretary-treasurer from 1937 to 1939. He was works manager of the Windsor salt plant of Canadian Industries Limited from 1935 to 1945. He went in 1945 to Watkins Glen, N.Y., as superintendent of the International Salt Company's plant.

Frederic Alport, M.E.I.C.

Charles E. Garnett, M.E.I.C.

Photo by Nakash

G. Lorne Wiggs, M.E.I.C.

Frederic Alport, M.E.I.C., who had been with the Department of Public Works of Canada for some 12 years, serving at Toronto, Halifax and Ottawa, has left the department to take up private practice at Orillia, Ont. In Ottawa, he has acted as representative of the Department on the Lake of the Woods Control Board. and has handled administrative work of the Northwest Territories, including the Yellowknife projects. He was a member of the special committee of three appointed by the Minister of Transport to study and report on the St. Lawrence deep water channel from Montreal to the sea. During the war he served as consulting engineer to the Director of Naval Services, and was awarded the Order of the British Empire in 1946 for distinguished services.

In his practice he will specialize in harbour works, tunnels, foundations, water supply and sewage disposal.

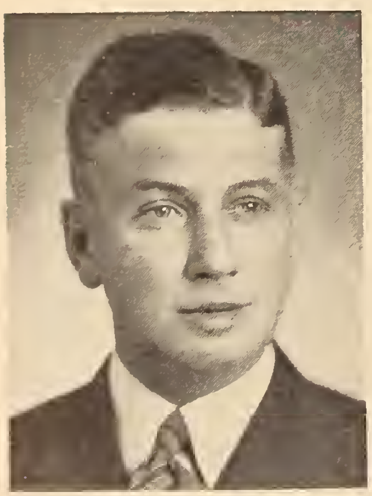
C. E. Garnett, M.E.I.C., was elected vice-president for Alberta of the Canadian Chamber of Commerce at the annual meeting of that body in October at Quebec, Que. President and manager of Gorman's Limited, Edmonton, Alta., and president of Gateway Gold Limited of Edmonton and Yellowknife, N.W.T., Mr. Garnett is also president of the Edmonton Chamber of Commerce. He is a past president of the Association of Professional Engineers of Alberta, and a past chairman of the Edmonton Branches of the Engineering Institute and the Canadian Institute of Mining and Metallurgy.

Drummond Giles, M.E.I.C., has been appointed to the Council of the Institute, to represent the Cornwall Branch. Mr. Giles is executive vice-president of Courtaulds (Canada) Limited, Cornwall. He assumed that position in 1944, relinquishing his post as special assistant to the co-ordinator of production in the Department of Munitions and Supply, Ottawa. He had previously been vice-president of Canadian SKF Company Limited, to whom he went in 1927 after graduation from McGill University, Montreal. Starting with Canadian SKF as an engineer at Montreal, he was successively assistant chief engineer and chief engineer at Toronto. In 1932 he was made district manager at Montreal and in 1938 vice-president.

G. Lorne Wiggs, M.E.I.C., announces the formation of a partnership, Wiggs, Walford, Frost and Lindsay, consulting engineers to render in Montreal a design and supervisory service in civil, electrical and mechanical engineering previously conducted by the firm of Lorne Wiggs and Company. The partners are: **G. Lorne Wiggs,** M.E.I.C., **John G. Frost,** M.E.I.C., **Leslie C. A. Walford,** and **D. Lorne Lindsay,** Jr.E.I.C.

Mr. Wiggs, following graduation from McGill University in 1921, worked for a number of the leading industrial and commercial firms in Canada and the United States. Early in 1929 he entered private practice in Montreal as a consulting engineer, specializing in the design of the electrical and mechanical equipment of building. His practice has extended across Canada and also to Newfoundland. During the war he was retained by the Department of Munitions and Supply. Since the termination of the war he has returned to the field of engineering of industrial plants and to the design of the electrical and mechanical equipment of building of all kinds. Mr. Wiggs has specialized in heating and air conditioning. He has contributed a number of papers to different branches of the Institute and to other engineering societies in Canada and the United States.

Mr. Walford, prior to the formation of the partnership, had been employed by Mr. Wiggs for about six years, after having acted as mechanical superintendent for the late J. S. Archibald, architect, of Montreal. During the war years, Mr. Walford was technical officer in the Artillery Ammunition Branch of the British Supply Mission in New York and



Drummond Giles, M.E.I.C.

E. McK. Nason, M.E.I.C.

W. F. S. Carter, Jr.E.I.C.

Washington and conducted liaison work between that Mission and the U.S. War Department. While associated with Mr. Wiggs he was responsible for all mechanical design work and has done much in the field of design of ventilation and air conditioning.

Mr. Frost has been associated with Mr. Wiggs for over four years, after having been employed by the Southern Canada Power Company and the Power Corporation of Canada for a period of nineteen years, during which period he acquired extensive experience in the design of steam and hydro-electric power plants, transmission lines, and high tension substations. He is the former chief engineer of Mr. Wigg's organization.

Mr. Lindsay graduated from McGill University in 1941 and joined the firm of G. Lorne Wiggs & Company over two years ago. After having served with great distinction as a Lieutenant (Engineering) in the Royal Canadian Navy Volunteer Reserve, he was appointed M.B.E. for his development of a new naval gun mounting. He has been in charge of all radiant heating design work of the firm since he joined it.

E. McK. Nason, M.E.I.C., is director of works for the city of Saint John, N.B. A graduate of the University of New Brunswick, he went immediately into the R.C.A.F., and was stationed at Moncton, N.B., and at Boundary Bay, B.C. On his discharge he joined the Canadian Pacific Railway at the Fredericton, N.B., engineering department. Later he was assistant city engineer at St. Catharines, Ont., until his recent appointment.

James P. Rubush, M.E.I.C., has been appointed west coast representative for the Improved Paper Machinery Corporation of Nashua, N.H. He is located at Wenatchee, Washington. He was previously vice-president in charge of sales with the Goslin-Birmingham Manufacturing Company, Inc., of New York, N.Y. He joined the latter company in 1944, coming from Chicago, Ill., where he was general manager of the Douthitt Grey Johnson division of Whiting Corporation.

Alexander Tobias, M.E.I.C., is practising as a consulting engineer in Toronto, Ont. He recently left the employ of the Standard Iron and Steel Works Limited, Toronto, Ont., for whom he was chief engineer. He was with that organization since 1943, starting as assistant chief engineer.

C. D. Osterland, M.E.I.C., is now manager of the Canadian General Electric Company Limited district office in Winnipeg, Man. A graduate of the University of Alberta, 1926, Mr. Osterland took the company's "Test" training and served for several years in switchboard engineering in the Peterborough Works. In 1935 he joined the apparatus division in Winnipeg, becoming its manager in 1942.

Rolf Lockeberg, M.E.I.C., is now associated with Canadian Ingersoll-Rand Company Limited, Montreal. He is a Queen's University graduate, class of 1940, and has recently completed requirements for the degree of M.B.A., at the Harvard Business School, Boston, Mass.

H. Francis Kent, M.E.I.C., has been transferred from Weston, Ont., where he was manager of the Weston Rock Wool Plant of the Canadian Gypsum Company to Hillsborough, N.B. There he is manager of the company's plant and gypsum mine.

G. M. Webster, Jr.E.I.C., has opened an office in Yellowknife, N.W.T., for consulting in mining engineering. He recently resigned his position as resident engineer for the Doris Yellowknife Gold Mines Limited and the LaSalle Yellowknife Mines Limited. He is a graduate of McGill University, 1941, with a bachelor's degree in mining engineering.

C. J. Tanner, Jr.E.I.C., has been elected chairman of the junior Section of the Saguenay Branch. His is assistant supervisor of Ore Plant No. 1, of Aluminum Company of Canada Limited at Arvida, Que., since 1943. He joined the company in 1943, coming from the Central Patricia Gold Mines, where he was assistant chief engineer. A graduate of Queen's University in 1939, he worked first with Wright, Hargreaves Gold Mines. Going to the Central Patricia Gold Mines as shift boss, he later was appointed assistant chief engineer.

W. F. S. Carter, Jr.E.I.C., president and general manager of the newly formed Canadian subsidiary of Sir George Godfrey and Partners Limited, has recently returned to Canada following an extensive tour of the company's English works.

Long established as engineers and manufacturers in England, Sir George Godfrey and Partners Limited, Hanworth, Middlesex, adds the Canadian subsidiary to a chain of similar ones established in South Africa and Australia. It is intended to establish a factory for manufacturing the company's products in Canada in the near future. The new company is known as Sir George Godfrey and Partners (Canada) Limited.

G. T. Perry, Jr.E.I.C., has resigned his position with the National Research Council in Ottawa, Ont., to accept the position of assistant chief chemist with the Shell Oil Company of Canada Limited, Montreal. He has been with N.R.C. since his graduation from University of Toronto in 1939.

R. H. Ansley, Jr.E.I.C., is now with the Commonwealth Construction Company at Vancouver, B.C. He was employed by the City of Winnipeg Hydro since 1946.

Marcel Brule, Jr.E.I.C., recently accepted employment with Canadian Resins and Chemicals, Limited, Shawinigan Falls, Que.

R. C. Cline, Jr.E.I.C., formerly with the American Can Company, Niagara Falls, Ontario, has joined the automotive engineering staff of the Ford Motor Company of Canada Limited, Windsor, Ont.

W. G. Grimble, Jr.E.I.C., received an appointment on November 1st as grade 2 engineer for the Dominion Department of Public Works at the New Westminster, B.C., district office.

W. C. M. Luscombe, Jr.E.I.C., is transferred to the Montreal office of Dominion Textile Company Limited. He was assistant mechanical superintendent for the Company at Magog, Que., since 1946 when he left the Aluminum Company of Canada Limited, Montreal.

Duncan McIntyre, S.E.I.C., is at the University of Wisconsin, Madison. He is a student research assistant in the hydraulic laboratory. He had been with the P.F.R.A. of the Department of Agriculture at Regina, Sask., since his graduation in 1946 from the University of Saskatchewan.

D. H. MacDonald, Jr.E.I.C., is employed as a junior engineer with the Rapid Transit Department of the Toronto Transportation Commission. He is a Toronto University graduate, class of 1946.

R. F. Shapcotte, Jr.E.I.C., is with Bennett and White Construction Company Limited, Vancouver, B.C., transferred from the Trail, B.C. office of the company where he was general superintendent and field engineer.

H. J. Whelan, Jr.E.I.C., is project engineer for Merck and Company Limited, Montreal, Que. He was previously a mechanical engineer with the British American Oil Company in Toronto.

Desmond Blair, S.E.I.C., is in the construction department of the S. S. Kresge Company, Toronto, Ont. A civil engineering graduate of University of Toronto, 1946, he was a resident engineer on municipal work for Armstrong, Anderson and Company since graduation.

R. J. Hallowell, S.E.I.C., is a construction engineer with the Steel Company of Canada, at Hamilton, Ont. He received his B.A.Sc. degree in civil engineering at University of Toronto this year.

William A. Landry, S.E.I.C., is at present on the engineering staff of St. Francis Xavier University, Antogonish, N.S. He is a Nova Scotia Technical School graduate of the class of 1946.

J. R. O'Grady, S.E.I.C., is transferred from Price Brothers and Co. Ltd., Quebec City, to be an engineer in the mechanical engineering department of the company's Kenogami Paper Mill at Kenogami, Que. He received the degree of B.Sc., in civil engineering from Queen's University in 1946.

J. P. Tessier, S.E.I.C., has received the degree of bachelor of applied science from Ecole Polytechnique, Montreal, and is now in the employ of H. J. O'Connell Limited, general contractors. He is the engineer in charge of bridge construction of the Chibougaman Contract.

R. D. Weekes, S.E.I.C., has accepted employment with the inspection department of the Associated Factory Mutual Fire Insurance Companies, Boston, Mass. He received the degree of bachelor of engineering, mechanical, from McGill University this year.

Obituaries

The sympathy of the Institute is extended to the relatives of those whose passing is recorded here.

T. T. Irving, M.E.I.C., of Orlando, Florida, died on October 18th after an illness of two months. In 1939 he had resigned the position of chief engineer for C.N.R., central region, Toronto. He had then completed 40 years of railway engineering.

Born in 1874 at Vernon River Bridge, P.E.I., Mr. Irving studied at McGill University, Montreal, graduating in 1898. He entered the Grand Trunk organization in Montreal where he worked on the double tracking of the Grand Trunk main line between Montreal, Toronto, and Chicago. He was resident engineer for four years and in 1902 was transferred to the Grand Trunk western division in a similar capacity. From that time, he was associated with practically every railway construction job of any importance, first as division and chief engineer in the Grand Trunk western territory for two decades and, from 1924, in Toronto as chief engineer of the Central Region of the Canadian National Railways. After his resignation in 1939 he resided in Florida at St. Cloud and at Orlando.

Mr. Irving joined the Institute as a Student in 1898, transferring to Associate Member in 1902, and to Member in 1940. He was awarded Life Membership in 1947.

George Fiske Hardy, M.E.I.C., senior partner of George F. Hardy and Son, consulting engineers, New York, who was born in Pequonock, Conn., in 1865, passed away on October 2nd, 1947. He had been known for many years as the "Dean of the Paper Industry" and had been responsible for the design of more paper mills of various types than any other individual American, pulp and paper mills and hydro-electric power developments throughout Canada and the United States, as well as mills in Newfoundland and Mexico.

He studied at Dartmouth University, receiving a B.S. degree in 1888. He was employed after graduation as an engineer for D.H. and A.B. Tower of Holyoke, Mass., specialists in pulp and paper mills, later to become a junior member of the firm under the name of A. B. Tower and Company. He resigned in 1896 to build a mill for the Hudson River Pulp and Paper Company, Corinth, N.Y. In 1897 he built a newsprint mill for the Laurentide Paper Company, Grand'Mère, Que., which was the first of its kind in Canada. The next year he was appointed chief engineer of the International Paper Company and resigned in 1901 to purchase the mill engineering business of the late A. B. Tower which had in the meantime moved to New York City.

He built a large number of paper and pulp mills and power plants since 1901, including the 275,000 hp. hydro-electric plant at Abitibi Canyon, Ontario, in 1930-32. From 1932 he was engaged largely in the development of the kraft pulp and paper industry in the southern States, which has included mills in Savannah, and St. Marys, Ga., Fernandina and Port St. Joe, Fla., Bogalusa and Munroe, La. He designed the first mill to make newsprint from southern pine at Lufkin, Texas, and recently completed the first modern sulphate pulp mill in Mexico. When he died he was working, on the design of the 600-ton per day kraft liner board mill for the Macon Kraft Company at Macon, Ga.

He was a director of the St. Croix Paper Company at Woodland, Maine. He served as New York district manager, Division of Supply Emergency Fleet Corporation in 1918. Dartmouth University awarded him the honorary degree of doctor of science in 1926.

Mr. Hardy joined the Institute in 1902 as a Member and he was granted Life Membership in January 1947.

Colonel F. M. Gaudet, M.E.I.C., a widely-known figure in Montreal military and engineering circles, died on November 3rd, 1947.

Col. Gaudet was born at Three Rivers, Que. He was educated at Ottawa University and later went to the Royal Military College at Kingston, Ont., from which he was graduated in 1887, winning the Governor General's medal. Commissioned in the R.C.A. permanent force in December 1887, he carried out engineering projects and in 1895 he was appointed superintendent of the Dominion Arsenal at Quebec. He was also in charge of experimental work for, and consulting ordnance expert to the Department of Militia and Defence. He remained for 18 years, leaving to serve in the army at the outbreak of the First World War.

He joined the 22nd Regiment and went overseas, serving in England and France and being mentioned in dispatches. In England he served on the technical staff of the Imperial Minister of Munitions. His engineering knowledge and munitions experience, gained at the Quebec Arsenal, caused him to be made managing director of the National Filling Factory at Hereford. He was honored by both the British and French Governments, receiving the C.M.G. decoration, and being created an officer of the Legion of Honour.

On his return to Canada, he became part of the old Decarie administration that had charge of municipal affairs in Montreal from 1919 to 1921. Col. Gaudet was made commissioner of municipal services and director of public safety. In 1921 he was made a director of the newly-formed National Research Council at Ottawa, and the following year he was made a director of the Canadian Industrial Alcohol Company Limited, Montreal, with which he remained until his retirement in 1929. During the Second World War, he emerged from retirement to take a post in the Cherrier plant of Defence Industries Limited, Montreal.

Colonel Gaudet joined the Institute in 1903 as a Member. He was awarded Life Membership in January, 1938.

George G. Powell, M.E.I.C., commissioner of works for the City of Toronto and a member of the Works Department for more than 40 years, died on November 16, 1947, at the Toronto Western Hospital. He had been seriously ill only a few days. Appointed commissioner of works in November 1945, he was familiar with every phase of the city's building construction and transportation during his association with civic service.

Mr. Powell was born in Toronto, in 1878. He attended Jarvis Collegiate there, and in 1898 he first entered civic service as a rod-man with the roadway section of the Department of Works. A year later he became a student in the School of Applied Science, University of Toronto, graduating in 1903. For a time Mr. Powell served with the Toronto and Niagara Power Company at Niagara Falls, in connection with the construction of the power plant at the foot of the Horseshoe Falls. Returning to Toronto in 1904, he joined the staff of the Constructing and Paving Company, and in 1906 he went to the employ of the city as assistant engineer of the roadway section. Four years later Mr. Powell was appointed principal assistant engineer to the late C. H. Rust, city engineer. In 1912 he became deputy city engineer to the late Roland C. Harris, and he received the appointment as commissioner of works in 1945.

He was a member of the Association of Professional Engineers of the Province of Ontario. He joined the Engineering Institute in 1907 as an Associate Member, becoming a Member in 1913. Life Membership was awarded to him in January 1947.

J. E. Carmel, M.E.I.C., the former engineer superintendent, building department, for the City of Montreal died on September 30th following a brief illness.

Born at St. Scholastique, Que., Mr. Carmel later came to Montreal and graduated from the Ecole Polytechnique, University of Montreal, in 1892. After graduation he accepted a position as town engineer in El Paso, Texas. He also served as town engineer at Austin, Texas, for a time before returning to Canada about 1900. On his return he was in charge of the engineering staff of J. E. Vanier, Montreal. Later he became town engineer for St. Louis, before it became part of Montreal. He was also town engineer at Laval de Montreal before accepting the post as engineer for Montreal proper. He was a member of the Cunningham commission, which at one time inspected all public buildings in Montreal for fire prevention measures. He also set up the Building Code for the city of Montreal. He retired in 1940 as engineer superintendent of buildings.

Mr. Carmel was a member of the American Concrete Association, and the Corporation of Professional Engineers of Quebec. He joined the Institute in 1917 as a Member.

T. M. MacNab, M.E.I.C., who had been since 1941, in British Guiana, on the staff of the Demerara Bauxite Company, died in Montreal on July 26, 1947. Born at Edmonton, Alta., in 1911, Mr. MacNab studied mining engineering at University of Alberta, graduating in 1936 with the degree of B.Sc.

After graduation he was first employed by the North-West Minerals Limited at Goldfields, Sask., as assistant engineer and assayer. In 1937 he was for a time assistant engineer for diamond drilling for the Falkenbridge Nickel Mines Limited at Outpost Island, N.W.T., and he went to the N. A. Timmins Company, Beauliew River, N.W.T., the same year, to serve as assistant engineer on power service. From 1937 to 1939 he was assistant general superintendent in charge of underground work for the Negus Mines Limited at Yellowknife, N.W.T. From 1939 to 1941 he was employed on the Manikuru Goldfields Limited at Arakaka, British Guiana. He joined this organization as assistant superintendent and was manager for ten months before his departure in 1942 to join the Demerara Bauxite Company in British Guiana, a subsidiary of the Aluminum Company of Canada. There he was manager of the Ituni Works and of the company town of Ituni.

He was a member of the Association of Professional Engineers of Alberta, and of the Canadian Institute of Mining and Metallurgy. He joined the Institute in 1946 as a Member.

Prof. J. J. Spence, M.E.I.C.

Professor J. J. Spence, M.E.I.C., of the staff of the University of Toronto, a former secretary-treasurer of the Toronto Branch of the Institute, died on October 30th, 1947.

Professor Spence was born in Toronto in 1885. He studied at Toronto University and obtained his electrical and mechanical engineering certificate in 1909. Professor Spence had previously attended Upper Canada College. After graduation he worked until 1913 with the consulting firm of Smith, Kerry and Chace at Toronto, and from 1913 to 1924 he was plant manager for Wood Turning Products Limited, Toronto.

He joined the staff of Toronto University in 1925 as a lecturer and remained with it until his death. He was promoted in October 1946 to the rank of assistant professor of engineering drawing.

He was an active member of the Toronto Branch of the Institute, and its secretary-treasurer for five years, 1937-42. He joined the Institute in 1926 as an Associate Member.

E. L. Ganter, M.E.I.C., of Sydney, N.S., died on August 29th, 1947. Born at Saint John, N.B., in 1891, he attended school there, but took his engineering course at Polytechnic Institute of Brooklyn, N.Y., graduating as an electrical engineer in 1912. He worked first with the New York Edison Company in New York City, and he returned to Canada in 1913, going into the electrical department of Canadian Pacific Railway. For three years he was associated with electrical contracting work. He then took the position of assistant inspector of gas and electricity for the Province of New Brunswick. Two years later he joined Canadian General Electric Company as manager of the office of the company at Sydney, N.S., and engineer for Cape Breton Island. At the time of his death he was manager of the Cape Breton Division of C.G.E.

Mr. Ganter joined the Institute in 1945 as a Member. He was also a Member of the Association of Professional Engineers of Nova Scotia.

F. A. Dickie, M.E.I.C.

Frank E. Dickie, M.E.I.C., of Lachine, Que., a Canadian metallurgical engineer well known in the aluminum industry, died suddenly of a heart attack in Wellington, New Zealand, on November 4th, 1947.

An employee of the Aluminum Company of Canada, Limited, for the past 22 years, Mr. Dickie had been in New Zealand for six weeks investigating the possibility of developing a branch of the Canadian aluminum industry in that country.

Mr. Dickie was born in Shediac, N.B., in 1887, and educated at Acadia College. He received a B.A. degree from Acadia in 1909 and went to Columbia University, N.Y., receiving a master of arts degree in 1912. He also studied chemical and mechanical engineering at Columbia. He worked as a chemist for Canada Cement Company in 1913-14 at Calgary, Alta., and at Exshaw, Alta., and he joined the Aluminum Company of Canada Limited in 1915. He was, for 11 years, assistant superintendent of the company plant at Shawinigan Falls. Later he was superintendent of the aluminum plant at Arvida, Que., in its early stages of development. At the close of 1926 he resigned from the company and spent several years in the United States and in Europe as an engineer on development projects. In 1937 he was re-engaged by the Aluminum Company and as technical assistant to the general manager handled special engineering assignments, including the managership of the company's brucite mines at Wakefield, Que.

Mr. Dickie joined the Institute in 1939 as a Member.

William U. Lee, Jr.E.I.C., died in hospital in Montreal on November 5th, 1947.

He was born in Montreal in 1921 and studied at Baron Byng High School and McGill University. He obtained the degree of bachelor of engineering, mechanical, in April 1945. While attending university, he gained experience during summer vacations at Dominion Bridge Company, Lachine, in 1942, at the Westmount Tool Works of Defence Industries Limited in 1943, and at the Steel Company of Canada, Montreal, the next year, as a junior draughtsman on maintenance. After graduating he became associated with Fraser-Brace Limited to work at the United Shipyards Limited as an engineer on piping. He was transferred by Fraser Brace Limited to the D.I.L. plant at Chalk River, Ont., in October 1945, where he was an engineer and expeditor on piping and mechanical equipment. In October 1946 he joined Dominion Engineering Works, Montreal, and he left the firm in March of this year due to ill health.

Mr. Lee joined the Institute in 1945 as a Student, transferred to Junior in 1947. He was also a member of the Chinese Institute of Engineers.

News of the Branches

Activities of the Twenty-eight Branches of the Institute and abstracts of papers presented

BORDER CITIES BRANCH

G. W. Lusby, M.E.I.C. - - *Secretary-Treasurer*
W. R. Mitchell, M.E.I.C. - *Branch News Editor*

The regular monthly dinner meeting of the Border Cities Branch was held at the Prince Edward Hotel on October 10th, with A. D. Harris, Chairman of the Branch, presiding.

The speaker for the evening was R. A. Trumper of the Special Products Division of Hobbs Glass Ltd., London, Ontario. Mr. Trumper's subject was **Looking Through Plexigloss,** and his talk was illustrated by a color film of thirty minutes duration.

Due to its crystal clarity, lightness, strength and other properties peculiar to it, Plexiglass was used widely during World War II in the manufacture of bomber noses and astra domes on air craft. Since the end of the war the material has found numerous and ever-widening applications in articles for civilian use. The speaker dealt fully with such applications and had numerous samples with him to elaborate upon his remarks.

The meeting wound up with a discussion period during which the general interest in the subject was clearly indicated by the large number of questions addressed to the speaker.

CALGARY BRANCH

J. F. Langston, M.E.I.C. - *Scretary-Treasurer*
T. M. Parry, M.E.I.C. - *Branch News Editor*

A general meeting of the Calgary branch was held on Thursday, October 16, in the Palliser Hotel.

After the reading of the minutes of the last meeting, and the chairman's opening remarks, J. P. Rounce, local manager of the Minneapolis-Honeywell Regulator Co. Ltd. addressed the gathering on the subject of **Application of Electronics in Industry ond Aviotion.**

The speaker introduced his subject with a brief outline of his company's initial venture into the field of measuring and control devices, 14 years ago, by its absorption of the Brown Instrument Company, of Philadelphia, which had pioneered the field on this continent.

Mr. Rounce discussed some of the uses made today of electronic controls, both in the home and in industry. These include control of gas furnaces, oil burners, automatic stokers; color detection of over two million shades; measurement of vitamins in food; opening of doors; operation of drinking fountains; and detection of flaws in metal. The oil and steel industries make extensive use of electronic controls.

Three very entertaining and instructive films, in technicolor and sound, prepared especially for the Minneapolis-Honeywell Company by the Walt Disney Studios, were then shown. They were entitled, "Basic Electricity", "Basic Electronics" and the "C-1 Automatic Pilot".

The last film illustrated very clearly the application of the balanced and unbalanced bridge network, together with the operation of gyroscope, amplifiers and servo-motors to take the place of the pilot's eyes, brain and muscle to keep the plane flying on a straight and level course. By the elimination of considerable pilot fatigue, greater safety is assured. In the war, the automatic pilot used in conjunction with the Norden bombsight made precision bombing possible, because 40 calculations could be completed in 10 seconds on the bombing run.

Another outstanding use of electronics for measurement purposes in aviation during the war, and since, was the use of a single instrument capable of measuring accurately to almost the last drop, the gasoline gallonage on the B-29 bombers. This one gauge replaced the 14 gauges formerly required by the old float method.

Fred Rhodes moved a vote of thanks to Mr. Rounce and the branch's programme committee for the excellent programme provided. A turn-out of 65 members and 32 guests gave the speaker a splendid audience.

* * *

The members of the Calgary branch held a general meeting on Thursday, October 30, in the Palliser Hotel.

After a short business session, Chairman M. W. Jennings introduced the speaker of the evening, B. W. Snyder, projects engineer, Canadian Western Natural Gas Co. Ltd., who gave an interesting talk on **The Red Deer Noturol Gos Pipe Line,** and illustrated it by photographs and sketches projected on the screen

In opening his talk, Mr. Snyder gave some details of the history leading up to the actual construction of the line. Before the war, several studies were made relative to bringing gas from the Kinsella fields to Calgary, because of the rapidly declining reserves of gas in Turner Valley. It was necessary as a part of these studies to calculate the size and cost of pipe line just large enough to serve the towns en route only, and to estimate the revenue they would yield if served with natural gas. The position with regard to gas reserves for Calgary improved considerably in the meantime, making the Kinsella-Calgary line unnecessary, but the scheme for piping gas to Red Deer and certain intermediate towns received further study which culminated in the construction of the project, actual work on which commenced in 1945.

The pipe line, as finally built, started at the village of Poe as a branch of the main line to Edmonton. From here, an 8-inch line was constructed, running south-westerly for nearly 70 miles; changing, near Ponoka, to 6 inches for the final 28.5 miles. The line was not designed to go further south than Red Deer. Short spans of 4-inch pipe supply Camrose and Wetaskiwin from the main line.

Mr. Snyder described some of the preliminary work which had to be done before the actual construction. Survey of the several trial routes and of the final route, purchase of the right-of-way and its clearance of bush and trees, were important preliminaries. A width of 20 feet was used generally, with 10 additional feet provided in certain places.

Farmers were given the right to crop right-of-way purchased from them and provision was made to compensate them for any damage to crops caused by repair, or service work on the pipe line.

In general, the construction of the line consisted of digging the ditch with ditching machines; stringing lengths of pipe alongside the ditch; lining-up and welding of the pipe; cleaning, coating and wrapping of the pipe; testing for "holidays" in the treatment, using a shop-made electrical high-voltage tester. After passing inspection of welds and coating, the pipe was placed into the ditch and back-filling was completed.

Some of the difficulties encountered and the methods employed in overcoming same were discussed by the speaker. These included such problems as sloughs, river crossings, highways and railways.

Many pieces of mechanical equipment were involved in the construction job—ditching and welding machines, tractors fitted with special equipment, trucks and trailers, cleaning, coating and wrapping machines, etc.

A number of members took the opportunity of asking questions relating to the project. A vote of thanks to Mr. Snyder for his interesting presentation was moved by J. de Hart on behalf of those present. The number of members registered was 60, and there were 17 guests.

EDMONTON BRANCH

W. W. Preston, Jr.E.I.C. - *Secretary-Treasurer*

A survey for gold, base metals and strategic minerals in the Lac de Gras region, 200 miles north-east of Yellowknife, N.W.T., was described by Dr. R. E. Folinsbee, assistant professor of geology, University of Alberta, in an address to the Edmonton Branch on October 15th at the Macdonald Hotel. Speaking of **Glociol Geology of the Borren Londs,** Dr. Folinsbee showed a fine collection of colored slides of rock formations, scenery, wild flowers and animal life which he photographed on recent expeditions in the Territories.

The speaker explained the existence of glaciers, and illustrated such evidences of their movements as erosions and glacial deposits. He also forecast that in the distant future glaciers may move south again and produce cold weather, or they may move farther north and, melting, cause the oceans to rise 100 feet, flooding port cities.

Dr. Folinsbee showed samples brought from the north, which included sand and a section of a tree from below the "snow line". The diameter would have indicated that the tree was 30 years old in the Edmonton region, but was actually 300 years old.

In spite of the fact that the Territories possess beautiful scenery, flower and bird life, animal and insect life, the geologist agreed that the region is properly called the "Barren Lands".

Dr. Folinsbee was introduced by J. A. Allan, and received a unanimous vote of thanks proposed by C. W. Carry. Attendance at the dinner was 48.

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Keeping the local interest in the oil industry alert, the Edmonton Branch featured two films on petroleum, at its monthly meeting, on November 15th, in the Macdonald Hotel. The films were shown through courtesy of the Shell Oil Company, at the conclusion of dinner which was attended by 63. A coloured film entitled "This Is Oil", or "Prospecting for Petroleum" treated of oil and the geology of oil structures. It also reviewed, by use of caricatures, the history of the search for oil from Drake's first "wild cat" well to modern practices involving scientific instruments. The second film, named "Ten Thousand Feet Deep" showed the difficulties of actual drilling operations. At the conclusion of the showings, W. J. Dick and J. A. Allan compared the situations illustrated in the films with local conditions.

The meeting concluded with the showing of the film "Camera Magic" explaining trick photography, and the coloured film "Radiant Rockies", showing various vacationing resorts in the Rocky Mountains.

HALIFAX BRANCH

J. D. Kline, m.e.i.c. - *Secretary-treasurer*
M. L. Baker, m.e.i.c. - *Branch News Editor*

About 80 members of the Halifax Branch, E.I.C., attended the dinner meeting on October 10 to welcome the President, Lt.-Col. L. F. Grant, on his official visit to Halifax.

Accompanying the President were: C. M. Anson, regional vice-president; J. B. Stirling, chairman, Committee on Professional Interests; G. A. Gaherty, councillor, Montreal Branch; E. O. Brown, councillor, Moncton Branch; C. D. McAllister, councillor, St. John Branch; R. C. Flitton, councillor, Montreal Branch, and W. D. Laird, assistant general secretary.

E. C. O'Leary, chairman of the Halifax Branch, presided at the meeting.

Following the introduction of the guests at the head table, Mr. O'Leary asked J. B. Hayes, immediate past-president, to introduce Lt.-Col. Grant. Mr. Hayes, in his inimitable manner, paid tribute to Lt.-Col. Grant for his contribution to engineering, to education, and to furthering the work of the Institute.

In the course of his address, the president pointed out that although Canada soon would have twice the number of engineers she had before the war, he did not fear that this would result in widespread unemployment in the field of engineering. He advanced three reasons for so thinking, (1) Many older engineers are now preparing to retire; (2) Canada is more highly industrialized than she had ever been, and hence, more engineering jobs will be made available; (3) Young men with engineering training were finding themselves in great demand in positions other than those directly related to engineering.

Lt.-Col. Grant spoke at some length of the benefits engineers derived from the Institute. He also pointed out several ways in which engineers themselves could help the Institute. He appealed to the members to give all possible aid to the local executive in carrying out its duties. He stressed the importance of close co-operation and harmonious relationship between the Institute and the Provincial Engineering Associations. He also mentioned the high regard in which the Institute was held by Professional Engineering Societies in the United States. Col. Grant concluded his address with the suggestion that the older members of the profession be ready and willing to give all possible help to the young engineer.

C. M. Anson spoke on the present measure of prosperity that Canada is now enjoying and said that such prosperity would continue only if markets for her production could be found. He suggested that Canadian engineers could contribute to the effort Britain is making to regain her economic stability, by buying from Britain some of the materials needed for engineering jobs.

The Halifax Branch was pleased indeed to welcome W. D. Laird in his official capacity as assistant general secretary. Mr. Laird, in a brief address, brought the members up to date on the current work of the Institute.

A feature of the meeting was the reading of a letter by Colonel Grant from Huber O. Croft, president of the American Society for Engineering Education, announcing that Dr. F. H. Sexton, lately president of the Nova Scotia Technical College, was elected to life membership in the Society. This award was made in recognition of Dr. Sexton's interest in the Society for a period of thirty years and of his notable contribution to engineering education.

In his response, Dr. Sexton commented on the work of the Society and the part it played in formulating ideals and setting standards in the field of education pertaining to engineering. Of special interest was his reference to one of the directors of the Society, Mr. F. M. Dawson, who was graduated from the Nova Scotia Technical College, in the class of 1910, and is now Dean of the Engineering College, University of Iowa.

It is perhaps pertinent to comment on the schedule of activities that was undertaken by the president on his official visit to the Halifax area. On Thursday, October 9, a motor trip was made to Wolfville where the president delivered an address to the engineering students of Acadia University. Thursday night, an executive dinner meeting was held at the Royal Nova Scotia Yacht Squadron. The object of this function was to enable the president and councillors to meet the members of the local executive.

Friday, October 10, the president delivered no less than four addresses, as follows: at 11.00 a.m. to the engineering students at St. Mary's College; at 3.00 p.m. to the students of the Nova Scotia Technical College; at 5.00 p.m. to the engineering students of Dalhousie University; and at night, as already has been mentioned, to members of the Institute at the dinner meeting. The rigor of this schedule was tempered somewhat by two social functions, the first, a luncheon at the Nova Scotian Hotel given by the Council of the Association of Professional Engineers of Nova Scotia, and the second, the dinner, to which reference has been made at the beginning of this report.

This report of the president's visit would be incomplete without some reference to the part played by the ladies. The members of the local executive and their wives were happy indeed to welcome to Halifax, Mrs. Grant and Mrs. Anson. In honour of the visitors, a dinner party was held at the Nova Scotian Hotel on Thursday, a motor trip around the Dartmouth Lakes, with lunch at Lakeledge, Waverly, and dinner at the Lord Nelson Hotel on Friday. Those events were under the capable direction of Mrs. E. C. O'Leary and Mrs. G. J. Currie.

On Saturday, a Regional Council meeting was held at the Nova Scotian Hotel. This meeting, beginning at 10.00 a.m., with an adjournment for lunch, lasted the greater part of the day. Members of the Halifax Branch executive and members of the Council of the Association of Professional Engineers of Nova Scotia, were invited to attend.

This meeting concluded the official business of the president at this Branch. Needless to say, all members greatly enjoyed and deeply appreciated the opportunity of meeting Lt.-Col. Grant, not only as President of the Engineering Institute, but as an engineer as well.

LETHBRIDGE BRANCH

Thomas Miard, m.e.i.c. - *Secretary-Treasurer*
J. A. Haberman, s.e.i.c. - *Branch News Editor*

On Saturday, Oct. 18, 1947, a group of 27 members of the Lethbridge Branch of the Institute, attending a meeting held at the Marquis Hotel in Lethbridge, heard Fire Chief W. H. Short's interesting talk on the subject **Fire Prevention.**

In 1946, there were 50,000 destructive fires in Canada and this year, there have been at least that number to date. Thus it is expected that the 1947 figure will exceed last year's by about 25 per cent. Many of these fires could have been prevented by proper precautions, and consequently, much loss of life and property avoided.

Chief Short's talks were followed by several reels of interesting moving pictures on the subject which were well received by those present.

A. L. H. Somerville introduced the speaker and C. Clendening moved a vote of thanks to which the members present indicated their appreciation.

Dinner music by Brown's Trio and vocal solos by D. S. Connell were features of the programme.

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Forty members and guests of the Lethbridge branch, Engineering Institute of Canada, participated in an interesting and educational tour of several South Alberta irrigation development areas on Thursday, Oct. 30, 1947. W. L. Foss, engineer in charge of S.M.R.D. development, explained the different undertakings.

The tour left Lethbridge at 2 p.m., proceeding first to the Pothole Coulee dam. The visitors were extremely interested in progress being made there, and watched heavy equipment of the New West Construction Company placing the earth fill.

Travelling to the St. Mary dam site near Spring Coulee, the tourists viewed tunnelling operations at the inlet of the diversion tunnel.

At the outlet end, the shaft was viewed which had been previously tunnelled for 1,000 feet. Concrete operations had been completed on the invert portion of the tunnel lining the day before. The engineers viewed with interest the general area and were shown that portion of the main canal which the Wells Construction Co. had completed to Pine Pound Coulee, a distance of two miles, and which included seven dams and dykes, the largest dam being 90 feet high.

In the evening the visitors were dinner guests of Wells Construction Ltd. with Verne Thierman acting as host.

MONTREAL BRANCH

It has been decided to hold the annual meeting of the Montreal Branch on January 22nd, 1948, at the Headquarters of the Institute. The business of the meeting will be kept to a minimum and the social aspect of the meeting will be stressed. It is hoped that as many members as possible will attend.

A dance will be held on the evening of February 13th, 1948, in the Ball Room of the Mount Royal Hotel. A buffet supper will be provided and arrangements are being concluded so that other refreshments may be purchased. The price of the tickets will be kept as low as possible and dress will be informal. It is expected that members will turn out in force and make this evening a great success.

The Engineers' Council for Professional Development held its annual meeting in Montreal on the 24th and 25th of October, 1947. Mr. R. H. Hobner, Chairman of the Branch Entertainment Committee, assisted by Mrs. Crawford, Madame Beauchemin, Mrs. Coke, Madame Gelinas and Mrs. Van Koughnet, arranged entertainment for the visiting ladies. On the Sunday following the meeting several groups of the visitors were taken by car for a tour of the Laurentian area by members who volunteered for this purpose. The Executive Committee wishes to thank all those who assisted in making the visitors' stay a pleasant one.

On October 29th a meeting of twenty-four high school student counsellors was held at Headquarters. This meeting was arranged by the branch's Student Guidance Chairmen, G. B. Moxon and L. A. Duchastel, for the purpose of explaining what assistance was available to them and their students. This committee is arranging symposia for the students and has set up a Panel of Counsellors who are members of the branch to assist students in need of advice.

The Membership Committee would be glad of the assistance of individual members to encourage their friends to join the Institute. The membership of the Branch during the year has not shown any appreciable growth. Dr. Huet Massue has shown in a report he has prepared that there are many practicing engineers who have not yet joined the Institute.

Members are requested to co-operate with the Executive by presenting notice cards at meetings when asked to do so. It is felt that some meetings have been over-crowded by persons who were not members or guests and it is to check on this that identification is requested. It also provides a means for more accurately determining the attendance.

Lectures given at the weekly meetings recently have included: **General Features of Suspended Monorail for Rapid Transit**—Mr. E. H. Anson; **The Mobile Telephone**—Mr. D. J. McDonald; and **Power Circuit Breakers**—Dr. G. R. Langley.

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Junior Section

Fundamentals of Supervision was the subject of the address delivered before the Junior Section on Monday, November 3rd, by H. B. Hanna, Supervising Industrial Engineer of Canadian Industries Ltd. The Supervisor's qualities and responsibilities were thoroughly reviewed for the benefit of the young engineer endeavouring to become a supervisor, in its fullest meaning, and not just another "boss". These qualities—to be industrious and energetic, enthusiastic, self-confident, co-operative, fair and a good instructor—are essential for successful personnel relations and personnel training. Briefly, a supervisor worthy of the name, is one who has attained competence in the management of men, methods, machines, materials, minutes and money.

The Junior Section Students' Night was held on Monday, November 17th, with four contestants out of 20 candidates presenting papers on subjects of their choice. Guy Perrault and Louis Desrosiers of l'Ecole Polytechnique presented respectively **Mistassini Expedition** and **Heat Recovery by Heating Towers in a Pulp Mill,** while R. V. Kovacs and J. P. G. Kemp of McGill University delivered papers on **Why British Columbia** and **Personnel Management.** After the delivery of the papers, Mr. Archie Macdonald, a well-known barrister in Montreal, gave pointers on effective speaking and commented on the delivery of the papers presented during the evening. A film, "Clear Track Ahead", was also presented, showing the importance of the railways as carriers of the nation's freight.

The Annual Meeting of the Junior Section will be held on Monday, January 26th. The main part of the evening programme will consist of the election of two councillors for the coming two years and the presentation of the new executive for 1948 to the Junior Section body. An entertaining film and refreshments will round out the evening.

NIAGARA PENINSULA BRANCH

P. A. Pasquet, jr.e.i.c. - *Secretary-Treasurer*
C. A. O. Dell, m.e.i.c. - *Branch News Editor*

Forty-seven members and friends of the Niagara Peninsula Branch met for dinner at the Red Casque Inn at Stamford, Ont., where they heard Mr. D. O. Robinson of the technical staff of Canada Cement Company speak on **New Developments in Concrete.** M. F. Ker occupied the chair and called on C. Climo to introduce the speaker.

Mr. Robinson, due to his long and close connection with the cement and concrete industries was able to bring many important new and pertinent ideas and developments to the attention of his audience. He stated that in the last eight years Canadian plants have changed one hundred percent from the dry to the wet process of manufacturing cement. This has been found to be advantageous in this country because it is difficult to store materials dry during the Canadian winter. This change has resulted in a reduction of cost and the production of a better and more uniform product. The trend in merchandizing has been toward bulk sales rather than bag sales and distribution is being made from warehouses located strategically throughout the country rather than from dealers. Greater use is also being made of bulk transportation by lake vessels than formerly. The speaker also mentioned the tremendous increase in the use of cement blocks as a wartime development in Canada as an important factor in the present demand and difficulty in maintaining stocks at the present time.

Turning to the engineering aspects of concrete design, concrete mixing, handling and placing, and also to research work aimed at eliminating some of the ills of concrete, Mr. Robinson reminded his listeners of the well known principle of "the greater the proportion of water in a concrete mix, the less the strength of the resulting concrete". In this connection he stated that two important new practices are now getting good results in the industry. The first is the use of a fourth ingredient in the mix, i.e. air. By the use of trial mixes using measured quantities in various proportions actual results as to the workability and ease of placing the concrete may be observed, and the mix best suited to the job in hand may be selected. Scaling, long one of the greatest bugbears in concrete work may now be prevented by the use of a certain technique in the introduction of air as a fourth ingredient in concrete mixes.

Mr. Robinson related incidents which led to the recognition, by state highway departments in the U.S.A., of the value of air as an ingredient. Their investigations showed that a particular concrete which was found to resist scaling contained millions of tiny air bubbles.

One theory resulting from these findings is that with ordinary concrete as it is worked, water makes its way to the surface, and in so doing leaves tiny channels. The concrete subsequently cures and the water evaporates but the tiny channels remain, through which water or other chemicals may later penetrate to cause scaling by frost or chemical action. With the bubble-entrained concrete the water does not make its way to the surface, and the bubble structure, in fact, prevents segregation of the ingredients of the mix. The tiny channels do not occur, and any liquid which may later be present to penetrate the concrete reaches only to the depth of the first layer of bubbles, which is in the order of a millionth part of an inch. It is to be noted that the bubble structure makes the concrete plastic and easy to work. The amount of air entrained is from four to six percent for best results. Ordinary concrete as used in this part of the country will weigh from 151 to 152 pounds per cubic foot and with entrained air the weight will be about 147 pounds per cubic foot. There is some reduction in strength but this is partly balanced out by weight reduction.

Mr. Robinson mentioned that a new method of handling concrete has resulted from the recent discoveries, e.g. the use of the central mixing plant. He spoke also of the use of the vibrating tool and the concrete pump, as well as the intrusion prepack method as used at Parker Dam.

Following the address a vote of thanks was tendered. It was evident that all present had benefited, as evidenced by the lively period of questions and open discussion which ensued.

OTTAWA BRANCH

C. G. Biesenthal, m.e.i.c. - *Secretary-Treasurer*
R. C. Purser, m.e.i.c. - - *Branch News Editor*

Introduced by Major Walker Kayes, of the Kingston Branch of the Institute, and thanked by Professor R. F. Legget, who recently took up residence in Ottawa, C. P. Disney, vice-president of Intrusion Prepakt, Ltd., gave an evening address on October 22 before the Ottawa Branch at the National Museum. Mr. Disney spoke on the subject of **Prepakt Concrete,** a revolutionary new method of making concrete especially adapted to underwater construction, and certain types of repair work.

With this new type of concrete, the forms are first filled to capacity with crushed stone. Through tubes leading at proper intervals into this mass a grout mixture of sand, cement, filler agent, and water is then pumped under pressure filling up all spaces between the stones. A continuous flow of grout is maintained until the forms are filled.

The method is particularly well adapted to underwater construction in that the grout when properly made will force out the water of a stream or lake and in no way mix with it. Expensive cofferdam construction is not necessary.

The speaker showed how the method was adapted to the economical underwater construction of piers right down to bed rock in cases where former methods would make such construction most difficult and costly. On this account, he felt that it would simplify bridge construction over water expanses that by former methods required huge and expensive spans. For instance, he said that the St. Lawrence River at the location of the Quebec Bridge could be bridged by using the new method at a cost of $3 million as compared with the actual cost of $48 million for the Quebec Bridge. In addition, the piers of the new bridge would be placed on a solid rock base in every case.

The speaker illustrated his talk by the use of slides showing how the method had been adapted to the construction and repair of dams, bridge piers, breakwaters, tunnel facings, and other structures. Following his address, many of the members present participated in a discussion upon the subject.

Major-General G. R. Turner, chairman of the Ottawa Branch, presided.

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At a noon luncheon on October 23, Col. H. L. Meuser, O.B.E., Director of Engineers, spoke on the **Royal Canadian Engineers in Peace-time.**

The peace-time service setup of the R.C.E., he said, was divided into three forces: active or full-time, reserve of part-time, and supplementary reserve available in times of emergency. The last he characterized as a "paper army only" where the personnel generally on account of their civilian occupations can be readily adapted to the army.

The majority of the active force officers were engaged in civil engineering. They were responsible for the construction and maintenance of all military buildings, fortifications and camps in Canada for active and reserve forces. The total new construction anticipated in Canada will cost many millions and will take many years to complete.

For the current fiscal year, expenditures will amount to about $13 million of which $6 million will be for day labour. It will extend from the Atlantic to the Pacific, and also to the Arctic. As examples of present construction, he cited the experimental station at Fort Churchill and a self-contained military camp with an adjoining town now under construction at Camp Borden, the camp for 2500 troops and the town for about 800 families.

In addition, army engineers were responsible for maintenance of the Alaska Highway in Canada, and thus officers and men received practical engineering experience in modern road and bridge construction on a comprehensive scale.

The development branch, built up during World War II, was continuing now on a reduced scale to follow the latest trends in engineering. Its main work was to design and develop equipment, paying particular attention to equipment best suited to Canada's climatic conditions.

The speaker appealed to the membership of the Engineering Institute and like organizations to support the peace-time R.C.E. He said the overall shortage of engineers in Canada was reflected in the force by a shortage of officers. When this shortage is overcome, it is the intention to attach engineering officers and men to many types of civilian projects of value to army experience. "It would definitely be of advantage for the R.C.E. personnel to have a broader scope of engineering experience than it has now", he said.

The speaker was introduced by Brig. A. Connelly and was thanked by J. A. Wilson. Chairman Major-General G. R. Turner of the Ottawa Branch presided.

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Recently Carleton College at Ottawa was designated by the Engineering Institute of Canada as a "school of engineering recognized by the Council". This recognition has followed as a result of the extension of the engineering courses of the College and allows students to apply for membership in the E.I.C.

Following his practice of addressing the engineering students of schools so recognized, Lt.-Col. L. F. Grant, president of the E.I.C., visited Carleton College on the afternoon of October 23, 1947. He was accompanied by the following officers of the Institute, all members of the Ottawa Branch; Dr. K. M. Cameron, past president; W. L. Saunders, vice-president; J. H. Irvine, councillor; Major-General G. R. Turner, chairman Ottawa Branch; and D. E. Kennedy, chairman of the membership committee Ottawa Branch.

The above were introduced, in turn, to the engineering student body by Professor L. N. Richardson, director of science studies, Carleton College, who expressed the gratification of the faculty and engineering students on the recognition of the College by the E.I.C.

Prof. Richardson then called on Lt.-Col. Grant who gave an interesting address in which he discussed the prospects of employment of engineers and the advantages of membership in the E.I.C. At the close of the address Lt.-Col. Grant was thanked by Archie Ward, president of the second-year engineering class. Dr. M. M. MacOdrum, president of Carleton College, also expressed thanks to Lt.-Col. Grant for his address.

Prof. Richardson next called on Major-General Turner who extended a cordial welcome to prospective student members of the E.I.C. to participate in the activities of the Ottawa Branch. He then asked Mr. Kennedy to tell the students about the proposed junior section of the Ottawa Branch.

Mr. Kennedy outlined the purposes and objects of a junior section and the steps now being taken to organize one in the Ottawa Branch. Mr. Saunders also addressed the students giving his views on the kind of employment they should endeavour to obtain during their summer holidays while undergraduates.

At the close of the meeting a very gratifying number of students signified their intention of joining the Institute, and their applications were endorsed by Mr. Kennedy and by Air Vice-Marshall E. W. Stedman, professor of mathematics at the College, and former member of the Council of the E.I.C.

PETERBOROUGH BRANCH

J. M. King, jr.e.i.c. - *Secretary-Treasurer*
J. C. Allan, m.e.i.c. - *Branch News Editor*

The 29th annual dinner of the Peterborough Branch of the Institute was held at the Empress Hotel on the evening of November 5. Sixty-five members and guests were present.

J. F. Osborn, chairman of the branch, introduced special guests, Lieut.-Col. L. F. Grant, president of the Institute; Mayor Ovens; Mr. W. D. Laird, assistant general secretary of the Institute; Lt.-Col. Turnbull; Dr. J. C. Dawson; Mr. E. A. Cross; Mr. J. F. McLaren and Mr. C. E. Sisson.

The chairman spoke briefly of the year's programme which is to lean toward general topics to provide opportunities for the citizens in general to hear scientific papers. This is very desirable because the Institute is the only scientific society in this city with meetings open to the public. The chairman expressed regret that Dr. Wright was unable to be present.

Mayor Ovens complimented the engineering profession on its contribution to the development and welfare of the country and suggested the formation of an Engineering Committee to advise the city on general problems.

Mr. Cross brought greetings from the Toronto Branch and invited Peterborough members to visit his branch on all possible occasions.

Mr. Laird spoke briefly on headquarter's hopes to improve the *Journal* and asked for more papers from the branches. He concluded by outlining the general arrangements for the coming Annual Meeting at Banff.

Mr. Sisson recalled the formation of the Branch and stressed its opportunities as the only technical organization in the community and the resulting privileges and responsibilities.

A short, one act film entitled "Bound to Win", which was produced by branch members in 1917, was shown.

A. R. Jones, introduced President Grant who spoke briefly of incidents in his tour of branches, and of Institute affairs. He expressed hope for happier relations between the Institute and the Professional Associations. These organizations are largely composed of the same people trying to do two different jobs, and their differences are due to misunderstandings. The president advised every member of the Institute to be a member of a Provincial Association and expressed the belief that all members of the Association should also be members of the Institute.

The president went on to discuss the problem of the large numbers of students in engineering colleges, stating that they are much too numerous. Factors which may compensate in part were listed as, the unusually large number of engineers reaching the age of retirement, and the increasing industrialization of the country. However, most of the present students must have realized from the beginning that openings for them would only be found outside of engineering. Engineering courses are widely regarded as the best preparation for general business positions in industry.

The president stated that the proposed field secretary for the Institute could be an aid in creating engineering employment. There are many municipalities and small concerns that do not have engineers in their employment now, but could benefit by having engineers.

The president concluded by calling on the profession in Canada to have confidence in itself. He outlined several lines in which we lead the world and showed how outsiders realize that, while the profession does not appear to do so.

Hubert Sills invited all present to a reception for the president at his home after the dinner meeting. About 60 availed themselves of the opportunity for an informal get-together.

SAGUENAY BRANCH

J. E. Dyck, m.e.i.c. - - *Secretary-Treasurer*

Junior Section

T. T. Anderson, jr.e.i.c. - *Secretary-Treasurer*

A meeting of the Junior Section of the Saguenay Branch was held in the banquet room of the Saguenay Inn on Wednesday October 8, 1947.

K. B. Jelly of the Aluminum Company of Canada Ltd., addressed the meeting on the subject of **Industrial Engineering, Its History and Present Practice.**

Mr. Jelly, a science '39 graduate from Acadia, is fully conversant with his subject, having had several years experience as an industrial engineer with the Aluminum Company of Canada Ltd.

The speaker showed how industrial engineering had its inception with the efforts of Frederic W. Taylor, in the Midstate Steel Company, on "Work Measurement Studies". Mr. Taylor was followed by Mr. Frank B. Gilbreth, who did for "Motion Study" what Mr. Taylor had done for "Work Measurement". For example, motion economies effected by Mr. Gilbreth in brick laying increased productivity from 120 to 350 bricks per man hour.

The speaker went on to point out that while industrial engineering had suffered during the depression years, the science had taken a new lease on life during the war years when increased productivity was a "must".

Mr. Jelly stated that present practice in industrial engineering includes the following which he outlined in some detail: Work simplification, time and motion study, wage incentives, job evaluation, and miscellaneous items such as merit rating, plant layout, production planning, product design, etc.

The talk was very interesting and enjoyed by all and resulted in a lengthy question period.

The speaker was thanked by J. J. Miller on behalf of the Junior Section following which sandwiches and coffee were served to the gathering.

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The annual meeting of the Junior Section of the Saguenay Branch was held at the Arvida Protestant School at 8.15 p.m., Wednesday, October 29, 1947.

Following Chairman Madill's opening address, the secretary-treasurer, T. T. Anderson, read the minutes of the last annual meeting, October 23, 1946. He also read the annual report, covering activities and finance. He indicated that the year had been very active, a total of eleven meetings being held, and that the treasury had made a slight gain over last year.

The chairman then read his annual report, pointing out in particular that the chairman of the Junior Section was now *ex-officio* a member of the senior executive. This measure had been passed by ballot of the Saguenay Branch in June 1946.

Elections were held, the following men being elected: Chairman, C. J. Tanner; Vice-Chairman, K. V. Gow; secretary-treasurer, F. Duffy; and Committee Members, K. B. Jelly, A. Bowden.

A discussion from the floor ensued in which J. J. Miller proposed a motion that the Junior Section constitution be changed to include a nominating committee for elections. It was decided that the motion would be presented for discussion at the next meeting.

A series of films were shown as follows: "Pluto", the film depicting the laying of the famous "Pipeline under the Ocean"; "Fido", the film on Incendiary Dispersal Of Fog; "Prevention and Control of Distortion in Arc Welding"; "The Art of Generating"—a film on surface generation; "Moose Skin"—a film on the various uses of moose skin.

The well-attended meeting adjourned at 10.45 p.m.

SAINT JOHN BRANCH

K. W. Salmon, jr.e.i.c. - - *Secretary-Treasurer*

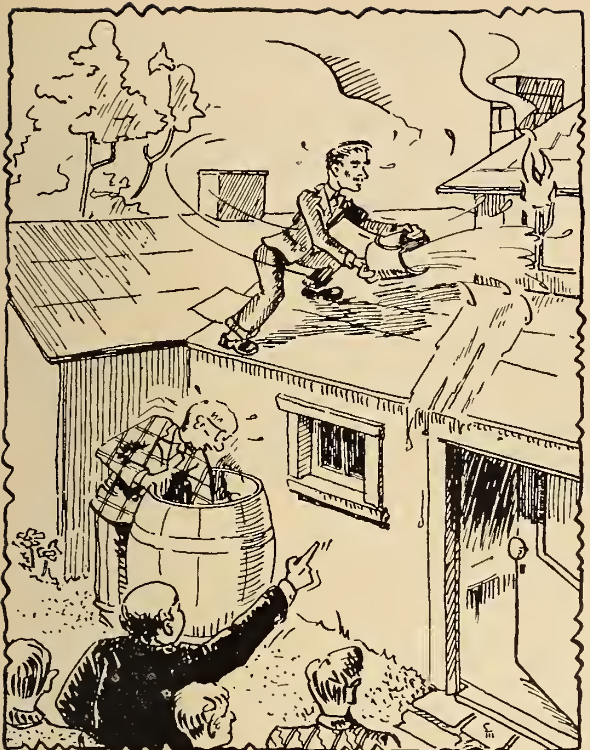
The Saint John Branch would like to announce at this time that it has originated and developed the most effective method of limiting a speaker's time that has yet been devised in the history of the E.I.C. This new procedure was engineered to such a high degree before actual working test that its maiden performance was successful beyond estimate. Test results are considered to be even more astounding due to the fact that the first test subject was no less a personage than our own President, Colonel Grant.

On Thursday, October 16th, about 12 members of the Saint John Branch accompanied the President to Fredericton, N.B., for a meeting with the students of the University of New Brunswick. Luncheon was taken with members of the Engineering Faculty at the D Coy Inn, a homey little bungalow, famed for its home-cooked chicken dinners, situated a few miles above the city on the beautiful Saint John River. Special guests in addition to Colonel Grant were the Chancellor of the University, Lord Beaverbrook, and G. A. Gaherty, President of Montreal Engineering Ltd. After a sumptuous meal and a few topical remarks by Lord Beaverbrook, Colonel Grant was introduced by Dr. E. O. Turner, Dean of Engineering.

The President was allowed to impart a few introductory words of wisdom and commence the lead-in to an after-dinner story, when all of a sudden the genial proprietress, Mrs. Coy, bustled into the room and announced rather breathlessly, "I am *terribly* sorry, but I am afraid I must ask you gentlemen to leave . . . the roof is *all* on fire!" The building was evacuated with a quiet quickness that was truly a tribute to the mass of engineering intelligence present.

Lord Beaverbrook's overall view of the scene from outside the little Inn must have been very impressive indeed . . . in fact, he made several remarks to this effect. Inside the single half-storey bedroom D. O. Turnbull, consulting engineer, Saint John, was efficiently tracing and removing the cause (with the help of two waitresses). Clothing, paper, etc., between the chimney and a beaverboard partition had ignited and spread to the roof. Shouts of "Tear out the beaverboard", emanating from inside the little room were hastily reinterpreted to Lord Beaverbrook.

In the meantime all was busy at roof and ground level. More than half of these present had found their way onto the roof by one means or another. . . . Councillor C. D. McAllister was among the first up there . . . the ground-level half was rapidly circulating in through the kitchen and back via a rear door bearing buckets, pots, pans, tins, basins, coffee-pots, chicken legs, cakes, cookies . . . the containers were filled with water at a convenient rain barrel and brigaded up to the roof peaks. The Branch Secretary and a faculty member were sighted toting a rather large two-handled container of a garbage-can variety to the side of the rain barrel only to have certain bystanders draw their attention to the fact that the bottom of the container was just not there . . . at the roof-top a group of "crowbar-and-axe" men were enthusiastically working their way in towards D. O. Turnbull, shingles flying . . . others were filling the gaps made by the "crowbar-and-axe" men with water passed up the line . . . shouts of "more water" were relayed down through the kitchen, and back up with the water itself to



Above—**Scene of the eventful Fredericton meeting as depicted by veteran student at U.N.B. and amateur artist C. L. Mofford, S.E.I.C.**

meet the counter-shouts of "No more water" . . . and up on the pinnacle, dispensing water from the finest container on the premises (a 5-gallon can with a push-button spout) was the owner of the interrupted speech, complete with pipe, our President!

After the quenching of the fire, the final subduing of the "crowbar-and-axe" men, and the acceptance of the owner's thanks for preventing serious damage, the party returned to Fredericton just in time to meet the assembled students at the University.

Such is the recorded procedure and summary of results for limiting the time of a speech. Some engineers may be of the opinion that the labor and expense of materials involved are entirely out of proportion with the results obtained and do not result in an efficient or economical operation. To these we would say only, that the President of the Engineering Institute of Canada has endorsed the procedure personally, and requests that the results be promulgated to all Branches.

SASKATCHEWAN BRANCH

D. W. Houston, M.E.I.C. - *Secretary-Treasurer*
R. Bing-Wo M.E.I.C. - - - *Branch News Editor*

The season's first dinner meeting of the Saskatchewan Branch of the Institute and the Association of Professional Engineers of Saskatchewan, was held in the Kitchener Hotel on October 17. Approximately thirty guests were in attendance. E. S. Carpenter was chairman of the meeting.

F. J. Fryer, superintendent of the Canadian Pacific Railway, spoke on **The Romance of Railroading.** He told of some of his experiences in travels for the railroad; of seeing logging and lumbering on Vancouver Island; mining, fruit and agriculture, cattle; grain of the Prairies; crude oil, sodium sulphate and other industries.

There are 788,672 miles of railroad in the world; 46.9 per cent are in North and South America; 5.3 per cent in Canada alone. In 1943 there were 42,343 miles of railroad in Canada. There are 48 points on the Canada-U.S. border where railroads cross from one country to another.

The longest non-stop passenger run in America is Union Pacific Diesel "The City of Los Angeles"—324.5 miles from Salt Lake City to Caliente, Nevada. The fastest scheduled run "The Morning Zephyr", C.B. & Q., 54.6 miles from East Dubuque, Ill., to Prairie du Chien, Wis., at an average of 84 m.p.h. The heaviest freight shipment on record, 488,200 pounds, a steel oil refinery fractionating column, was handled in the U.S.A.

Mr. Fryer also explained some of the forces which affect the operation of a locomotive engine. One of these is the "dynamic augment" or hammer blow caused by the centrifugal force of the counter weights. Another is the so-called "nosing or swaying couple" which is caused by the unbalanced reciprocating masses of the left and right-hand crank pits. This force reaches a magnitude of 104,000 foot pounds. "Positive and negative acceleration" is the effect of the right hand crank pin at 45 degrees below front dead center, and the left hand crank pin at 45 degrees above front dead center. The resultant component of the centrifugal force of the unbalanced weight of the reciprocating masses causes a positive acceleration tending to push the engine forward in the front 45 degree quarter and a deceleration in the rear 45 degree quarter.

Mr. Fryer closed his talk with the story of the origin of the song "Casey Jones". Casey Jones was an engineer employed in the 1890's on the Mississippi Division of the I.C. His real name was John Luther Jones and to distinguish him from other "Jones'" his friends nicknamed him "Casey" because he came from Coyce, Ky. The famous ballad originated with Wallace Saunders, a Negro engine wiper of Jackson, Tenn., when he heard that Casey had died a heroic death at the throttle of his engine.

Mr. Stewart Young moved a vote of thanks to the speaker for his very interesting address.

TORONTO BRANCH

E. G. Tallman, M.E.I.C. - *Secretary-Treasurer*
D. D. Whitson, M.E.I.C. - *Branch News Editor*

A meeting of the Toronto Branch was held on October 23, 1947, in Botany Building of University of Toronto, with an enthusiastic attendance of 165.

The speaker was P. B. Dilworth, manager and chief engineer of the Gas Turbine Division of A. V. Roe (Canada) Ltd. His lecture on **Jet Engine Development in Canada** was illustrated with interesting slides of a historical character depicting early steam jets, early gas turbines for stationary use, down to the latest models for aircraft use, and slides of the manufacturing and laboratory facilities at the A. V. Roe Malton plant.

Mr. Dilworth's paper is printed in full elsewhere in this issue of the *Journal,* and is therefore not summarized here. The paper elicited the keenest "question and answer" period witnessed by the Toronto Branch in a good many years. Mr. Dilworth, who participated in the discussion for almost an hour, was suitably thanked by Professor Wiren of the University of Toronto.

WINNIPEG BRANCH

R. T. Harland, M.E.I.C. - *Secretary-Treasurer*

Electrical Section

L. A. Bateman - - - - - - - - *Secretary*
D. C. Bryden - - - - - - - - *News Editor*

The first two meetings of the 1946-47 season are reported here by the Electrical Section of the Winnipeg Branch.

On October 2, E. Kelsey, consulting engineer, electronics engineering department of the Northern Electric Company addressed a joint meeting of the Electrical Section and the Institute of Radio Engineers' Winnipeg Subsection. His subject was **Problems in Connection with Establishing a Radio Station,** and he touched on the general problems of frequency choice, coverage, use of directional antennae, and also the problems of frequency modulation. Mr. Kelsey was well informed on his subject, and most interesting.

D. A. McCuaig, M.E.I.C.

Thursday night, November 6th, C. P. Haltalin, supervisory engineer of the Winnipeg Electric Company spoke on **Maintenance and Testing of Oil Circuit Breakers**. The talk was a summary of Mr. Haltalin's findings on this subject in his investigation during the last several years. Mr. Haltalin has done a considerable amount of pioneering in this field and, in the progress of the work, developed an analyser that will draw a chart enabling the analysis of the mechanical movement during a circuit breaker operation. In addition to outlining the breaker faults that this analyser has uncovered and their method of correction, he also outlined some original changes that have been made to operating mechanisms to improve their operation. The analyser was demonstrated and the whole talk supplemented with data relative to circuit breaker maintenance.

A paper for the December meeting has not been chosen at the time of writing. In January Paul M. Ross, superintendent of the H.V. Laboratory of the Ohio Brass Company, Mansfield, Ohio, will address the section on **Burning of Wood Structures by Leakage Currents**. Our Annual Dinner and Dance will be held in the Marlborough Hotel on March 12th.

D. A. McCuaig is chairman of the Electrical Section.

Library Notes

Book notes, Additions to the Library of The Engineering Institute, Reviews of New Books and Publications

BOOK REVIEW

NEW CITY PATTERNS; THE ANALYSIS OF AND A TECHNIQUE FOR URBAN REINTEGRATION

S. A. Sanders and A. J. Rabuck. N.Y., Reinhold, 1946. 197 pp., illus., cloth, $8.00.

Reviewed by

Clifford A. Meadows, M.E.I.C.*

We have inherited much of the geography of our present communities from our forefathers—the hardy pioneers who wrested our land from the former inhabitants and established settlements in the midst of the dense forests that then existed. As the population increased and hamlets grew to villages the government of the day caused sites to be selected and laid out to provide for streets, houses and community buildings. In spite of the fact that the available land was practically unlimited, the sites, usually planned in England, were laid out along the lines currently popular in that country and in most instances disregarding entirely the topography of the land comprising the site. As a consequence the natural configuration of the land had to be altered to suit the right angle pattern of the streets, and roads instead of winding up a hill at an easy grade were made to head straight into the hill necessitating costly cuts and fills. It has been said that cows and goats are better town planners than many of the surveyors and town planners of those days. And many a lovely pond and snug ravine has required filling by ashes and tin cans to allow our straight line streets to go through.

The narrowness of our streets was thought to be desirable in those days to keep the community small and compact for ease of communication and defence from the Indians and wild animals and when the streets carried horseback travellers and later comparatively few horsedrawn vehicles it was not apparent that wide traffic ways would ultimately be required. It is true that in the city of Paris before the dawn of the 19th century, wide main boulevards were established and might have been used as examples by the planners of our communities, but who thought in those days that out of the wilderness would be carved large communities whose traffic would need streets fully as wide.

At least one farsighted person thought along the right lines. Mrs. Anna Jamieson writes in 1837 in her book "Winter Studies and Summer Rambles"—

> "The town was, however, already marked out in streets running parallel with the shore of the bay for about two miles, and crossed by others at right angles. It is a pity that while they were about it, they did not follow the example of the Americans in such cases, and make the principal streets of ample width; some hundred feet, or even furlongs more or less, would have made little difference where the wild unowned forest extended, for all they knew, from the lake to the north pole—now, it would not be so easy to amend the error."

And so in practically every community in Canada we have had networks of narrow right angled streets to hamper us for generations and it is high time we set about to institute a change for the benefit of our children and our children's children.

Few communities have sufficient play space and parks for children of all age groups and for grown-ups. By re-planning our communities it is possible to adequately provide for play space.

Many communities lack centres where the citizens may gather for sports, meetings, concerts, etc., and an undertaking to plan the community offers the occasion to integrate a community centre into the official plan.

In "New City Patterns" the authors have presented a book replete with many valuable pictures that tell an eloquent story of what planners are working out, the world over, to overcome the present situation in old settlements and to plan new communities in a manner that will result in much better living conditions than obtain at the present time.

The book should be in the library of every Planning Board, every Planning Official and every Engineer actively engaged in the work of Planning Communities.

**General Manager, Meadows, Critoph & Co., Professional Engineers, Toronto, Ontario.*

CORRECTION

CONCRETE MATERIALS AND PRACTICE

L. J. Murdock. London, Edward Arnold, 1946. Reviewed by Karl E. Whitman, Engineering Journal November 1947, page 565.

This book is published in Canada by *Longmans, Green*, Toronto, and not by Macmillan as stated.

PUBLICATIONS OF OTHER ENGINEERING SOCIETIES

The following Institution should be added to the list which appeared in The October 1947 issue of the Journal, page 494:—

INSTITUTION OF ENGINEERS (INDIA)

Journal, single copies	3s-0d	4s-5d
Per Year (4 issues)	12s-0d	18s-0d

ADDITIONS TO THE LIBRARY

TECHNICAL BOOKS, ETC.

Aircraft Hydraulic Equipment:
R. H. Bound. Cheltenham, Dowty Equipment Ltd., 1940. 99 pp., illus., cloth.

Chemical Process Principles; Part Two—Thermodynamics:
Olaf A. Hougen and Kenneth M. Watson. N.Y., Wiley, 1947. 904 pp., illus., cloth.

Coal and Petroleum Products Commission (British Columbia):
Report of the Commissioner. Victoria, King's Printer, 1937. 3 vols., illus., cloth.

Economic Survey of the Mining Industry in Northwestern Quebec:
Montreal, Mines and Natural Resources Section of the Montreal Board of Trade, 1946. 70 pp., illus., leather.

Eighth Census of Canada 1941—Volume VIII: Agriculture:
Dominion Bureau of Statistics, Ottawa, 1947. 2 parts, illus., fabrikoid.

Electric Motor Maintenance:
W. W. McCullough. N.Y., Wiley, 1947. 125 pp., illus., cloth.

Elements of Aerofoil and Airscrew Theory, 2nd ed.:
H. Glauert. Cambridge, Cambridge University Press, 1947. 232 pp., illus., cloth.

Electronic Transformers and Circuits:
Reuben Lee. N.Y., Wiley, 1947. 282 pp., illus., cloth.

FM Radio Handbook:
Milton B. Sleeper, Great Barrington, Mass., FM Company, 1945. 174 pp., illus., paper.

Fractional Horsepower Electric Motors:
Cyril G. Veinott. N.Y., McGraw-Hill: 1939. 431 pp., illus. cloth.

Fundamentals of Engineering Mechanics:
Alvin Sloane. N.Y., Prentice-Hall, 1947. 378 pp., illus., cloth.

Hiduminium—Technical Data:
High Duty Alloys Ltd., Slough. 45 pp., illus., cloth.

Industrial Experimentation:
K. A. Brownlee. Brooklyn, Chemical Publishing Company, 1947. 151 pp., illus., cloth.

Industrial Management, 4th ed.:
William R. Spriegel. N.Y., Wiley, 1947. 656 pp., illus., cloth.

Magnetic Control of Industrial Motors:
Gerhart W. Heumann. N.Y., Wiley, 1947. 589 pp., illus., cloth.

Metallurgy, 3rd ed.:
Carl G. Johnson. Chicago, American Technical Society, 1947 418 pp., illus., cloth.

Modern Telegraph Systems and Equipment:
W. T. Perkins. London, Newnes, 1946. 216 pp., illus., cloth.

Physical Chemistry and the Technology of Fuels:
Alfred William Gauger. State College, Pa., Pennsylvania State College, 1947. 114 pp., illus., paper.

Research Laboratories of High Duty Alloys Ltd. at Slough:
High Duty Alloys Limited, Slough. Illus., cloth.

Structural Analysis; the Solution of Statically Indeterminate Structures:
W. Fisher Casile. London. Longmans, 1947. 260 pp., illus., cloth.

Scottish Railway Network:
J. F. Pownall. Birmingham, Cotterell, 1946. 71 pp., illus., cloth.

Tables of Physical and Chemical Constants and Some Mathematical Functions: 9th ed.:
G. W. C. Kaye and T. H. Laby. London, Longmans, 1941. 181 pp., illus., cloth.

Television, Volumes III and IV, 1938-41 and 1942-46:
Radio Corporation of America, Princeton, N.J., 1946-47. 2 volumes, illus., cloth.

Theory and Design of Cylindrical Shell Structures:
R. S. Jenkins. London, ON Arup Group of Consulting Engineers, 1947. 75 pp., illus., paper.

Waterbury's Vest-Pocket Handbook of Engineering, 4th ed.:
Wiley, N.Y., 1947. 386 pp., illus., leather.

Watkins Cyclopedia of the Steel Industry:
Pittsburgh Steel Publications, 1947. 468 pp., illus., cloth.

PROCEEDINGS, TRANSACTIONS, ANNUALS, ETC.

American Society of Civil Engineers:
Transactions, Volume III, 1946.

Canadian Electrical Association:
Proceedings, Fifty-Seventh Annual Convention, 1947.

International Civil Aviation Conference:
Report, 1944.

Koninklijk Instituut van Ingenieurs:
Jubileum, 1947.

Ontario. Department of Mines:
Fifty-Sixth Annual Report, Volume 56, Part 4, 1947.

Smithsonian Institution:
Annual Report of the Board of Regents, 1946.

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Canada. Forest Products Laboratories. Mimeographs:
No. 118—Durability of Jack Pine Saplings as Affected by Season of Cutting and Subsequent Conditioning and by Different Types of Soil, M. J. Colleary.—No. 127—Use of Sawdust as Fuel at Portable and Small Stationary-type Sawmills, C. E. Baltzer and J. B. Prince.

Electrochemical Society: Preprints:
92-5—Semi-Quantitative Method for Measuring the Ductility of Chromium Electrodeposits, M. R. J. Wyllie.—92-6—Ruben Cell—a New Alkaline Primary Dry Cell Battery, Maurice Friedman and Charles E. McCauley.—92-7—Observations on the Failure of 80 Nickel—20 Chromium Alloy at Excessive Temperatures, H. D. Holler.—92-8—Preparation of a Dry Cell Depolarizer by Air Oxidation of Manganous Hydroxide, L. C. Copeland, F. S. Griffith, and C. B. Schertzinger.—92-9—Some observations on Decomposition Voltages, J. O'M. Bockris and S. Ignatowicz.—92-10—Electrolytic Reduction of Acetone to Pinacol, O. C. Slotterbeck.—92-11—Electrolytic Reduction of Cinnamic Acid; Structure of the Products, Christopher L. Wilson.—92-12—Corrosion and Growth of Lead-Calcium Alloy Storage Battery Grids as a Function of Calcium Content, U. B. Thomas, F. T. Forster, and H. E. Haring.—92-13—Rapid Determination of the Calcium Content of Lead-Calcium Alloys by Titrating in the Molten State with Metallic Antimony, G. M. Bouton and G. S. Phipps.—92-14—Hydrogen Gas Electrode Measurements, George A. Perley.—92-15—Industrial Salt-Bridge Junction Tube, George A. Perley.—92-16—Recent Progress in the Metallurgy of Malleable Zirconium, W. J. Kroll, A. W. Schlechten, W. R. Carmody, L. A. Yerkes, H. P. Holmes, and H. L. Gilbert.—92-17—Electrolyte Equilibria in Relation to Dry Cell Performance, N. C. Cahoon.—92-19—Balanced Alkaline Dry Cells, Samuel Ruben.—92-20—Reduction of Acetylene to Ethylene by Chromous Chloride, Walter E. Barker and Douglas J. Kennedy.—92-21—Air-Depolarized Primary Cell with Caustic Alkali Electrolyte II, George W. Heise, Erwin A. Schumacher, and Charles R. Fisher.—92-22—Production of Potassium Perchlorate, Clifford A. Hampel and P. W. Leppla.—92-23—Electrolytic Reduction of Hexoses, Edward A. Parker and Sherlock Swann, Jr.—92-24—Commercial Production of Perchlorates, Joseph C. Schumacher.—92-25—Electrolytic Production of Chlorates, N. C. White.—92-26—Automatic Recording of Titrations, J. M. Gonzalez Barredo, and John Keenan Taylor.—92-27—Coordination Compounds in the Electrodeposition of Chromium, R. W. Parry, Sherlock Swann, Jr., and John C. Bailar, Jr.

Illinois. Department of Registration and Education. State Water Survey Division. Bulletin:
No. 37—Causes and Effects of Sedimentation in Lake Decatur, Carl B. Brown, J. B. Stall and E. E. DeTurk.

Institution of Mechanical Engineers. Advance Papers:
Fourth Report of the Research Committee on High-Duty Cast Irons for General Engineering Purposes: Acicular Cast Irons, J. G. Pearce.—Measurement of the Temperature of Sliding Surfaces, with Particular Reference to Railway Brake Blocks, R. C. Parker and P. R. Marshall.—Presidential Address of Lord Dudley Gordon.—Recent Developments in Automobile Transmissions, Ewen M'Ewen.—Some Design Aspects of Poppet-Valve Cylinder Heads for Spark-Ignition, Liquid-Cooled Engines, J. Swaine.—Some Notes on the Design, Development, and Production of High-Speed Compression-Ignition Engines, S. Markland and N. Tattersall.—Theoretical Discussion of Pitting Failures in Gears, R. Beeching and W. Nicholls.—Thrusts and Stresses in Two-Dimensional Pipe Expansion Bends, J. R. Finniecome.

North-East Coast Institution of Engineers and Shipbuilders. Advance Copies:
Marine Turbine Research and Testing Station, T. W. F. Brown.

Laboratoria N. V. Philips' Gloeilampenfabrieken. Separaat:
No. 1706—Note on Singularities Occurring at Sharp Edges in Electromagnetic Diffraction Theory, C. J. Bouwkamp.—1707—Hypothesis of Minimum Voltage in the Theory of the Arc, W. Elenbaas.—1709—On the Zeros of a Polynomial and of its Derivative, N. G. DeBruijn.—1710—Influence of Retardation on the London-van der Waals Forces.—1712—Lattice Structure of the Free Surface of Alkali Halide Crystals, E. J. W. Verwey.—1713—On Electro-Osmosis ans Streaming-Potentials in Diaphragms, J. Th. G. Overbeek and P. W. O. Wijga.—1719-1721—On the Dissection of Rectangles into Squares I, II, and III, C. J. Bouwkamp.—1725—Effect of Temperature on the Permittivity of Barium Titanate, J. H. Van Santen and G. H. Jonker.—1727—On the Relation Between Deformation and

Recrystallization Texture of Nickel-Iron with Cubic Orientation, J. F. H. Custers.—1730—Theory of the Stability of Lyophobic Colloids, E. J. W. Verwey.—1731—Fluorescence of Cadmium Borates Activated by Manganese, Th. P. J. Botden and F. A. Kroger.—1732—Fluorescence of Tungstates and Molybdates.—1733—Tetravalent Manganese as an Activator in Luminescence. —1735—Total Emission Noise in Diodes.—1737—Gyromagnetic Resonance in Ferrites.

Princeton University. Industrial Relations Section. Selected References:

No. 18—Taft-Hartley Act.

RCA Technical Papers: Index:

Volume I—1919-1945.—Volume II (a)—1946.

U.S. Geological Survey. Bulletin:

935—Geologic Investigations in the American Republics, 1941-43.—944-B—Lead-Silver Deposits of the Clark Fork District, Bonner County, Idaho.—953-C—Aluminous Lateritic Soil of the Sierra de Bahoruco Area, Dominican Republic, W.I.

U.S. Geological Survey. Water-Supply Paper:

866-C—Geology of Dam Sites on the Upper Tributaries of the Columbia River in Idaho and Montana.—992—Bibliography and Index of Publications Relating to Ground Water Prepared by the Geological Survey and Cooperating Agencies.—998—Suspended Sediment in the Colorado River, 1925-41.—1016—Water Levels and Artesian Pressure in Observation Wells in the United States in 1944:—Part I—Northeastern States.—1032—Surface Water Supply of the United States, 1945: Part 2—South Atlantic Slope and Eastern Gulf of Mexico Basins.—1034—Surface Water Supply of the United States, 1945: Part 4—St. Lawrence River Basin.

Yale University. Bureau of Highway Traffic. Technical Report:

No. 2—Toll Bridge Influence on Highway Traffic Operation, M. Earl Campbell.

World Power Conference. Fuel Economy Conference:

Papers.

STANDARDS, SPECIFICATIONS, ETC.

American Society for Testing Materials. Standards:

ASTM Standards on Adhesives.

British Standards Institution. Code of Practice:

CP(B)681—Structural Use of Timber in Buildings (Interim).

British Standards Institution. Specifications:

10: Part I: 1947—Pipe Flanges for Land Use (For Pressures up to 400 feet head).—448: 1947—Electronic-Valve Bases, Caps and Holders.—466:1947—Electric Overhead Travelling Cranes for General Use in Factories, Workshops and Warehouses.—1382:1947—Portable Fire Extinguishers of the Gas/Water Pressure Type (Riveted Construction).—1397:1947—Safety Belts and Harness.—1399:1947—Rotary Shaft Oil Seal Units (Related Dimensions).—1401-3:1947—Copper and Brass Tubes for Gas Installation Work and Gas Lighting Fittings.—1410:1947—Mastic Asphalt Flooring;Natural Rock Containing 6-10 Per Cent Bitumen.

PAMPHLETS, ETC.

Air Navigation Regulations, 1946:

Ministry of Civil Aviation, Great Britain. London, HMSO, 1946.

Conservation by Better Utilization:

T. A. McElhanney. Ottawa, King's Printer, 1947.

Conservation; Key to the Future:

Robert C. Hanson. Montreal, Montreal Star Company.

Dominion Conveyor and Elevator Belting Handbook:

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Electric Furnace Practice in Canada:

J. L. Balleny. 1947.

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Air Registration Board, London, 1945.

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T. A. McElhanney. Ottawa, King's Printer, 1947.

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H. B. Hanna. Montreal, 1947.

General Description of Suspended Monorail for Rapid Transit:

E. H. Anson. N.Y., Gibbs and Hill, Inc., 1947.

Inspection Approval of Firms under the Air Navigation Acts:

Air Registration Board, London, 1944.

List of the Non-Parliamentary Publications of the Aeronautical Research Committee:

HMSO, London, 1938.

Notes on the Regulations Governing the Airworthiness of Civil Aircraft Registered in Great Britain and Northern Ireland:

Air Registration Board, London, 1946.

Television; a Bibliography of Technical Papers by RCA Authors, 1929-1946:

Radio Corporation of America, Princeton, N.J., 1946.

Times Survey of the British Scientific Instrument Industry:

London, The Times, October, 1947.

Water Resources of the State of California:

Carl F. Wente. 1947.

BOOK NOTES

The Institute does not assume responsibility for any statements made; these are taken from the preface of the text of the book.

Prepared by the Library of The Engineering Institute of Canada

American Standard Building Requirements for Steel Joist Construction A87. 1-1947:

N.Y., American Standards Association, 1947.

These Standards cover the use of "Steel Joist Construction" in any structure erected under the provisions of the building code. They supplement the general provisions of the building code in order to provide for the proper design and erection of structures of this type of construction. Steel joist construction as governed by these requirements shall be that type of construction in which decks or top slabs are supported by separate steel members, spaced not farther apart than 24 inches on centers in floors and 30 inches on centers in roofs, but in no case spaced farther apart than the safe span of the top slab, deck, or flooring over the steel joists. The standard is significant in that for the first time the American Standards Association has given its official approval to a standard covering light-weight floor construction.

Bases de la Resistance Mecanique des Metaux et Alliages:

Pierre Laurent, Jacques Valeur, and Serge Bogroff. Paris, Dunod, 1947. 282 pp., illus., 10 x 6½ in., paper, 1200 fr.

This book is a survey of the advancement of understanding of the properties of matter. In the understanding of matter, being able to foresee the results obtained by every chemical or physical change will have important consequences. It is especially beneficial for metallic alloys, and this book presents a new step in this field. It outlines our present knowledge, and follows the evolution of the ideas of earlier times. It shows the significance of mechanical experiments and their results; the results of plasticity and the properties of alloys; the many aspects of the resistance of metals; and the harmony produced by modern physical theories.

British Standard for Hose Connections for Welding and Cutting Appliances:

London, British Standards Institution. 2/-.

This Standard fixes the size of hose connections in order to facilitate a change in the size of a cutting or welding blowpipe, or an interchange between the two, with a minimum change of hose. It deals with the connection at the inlet end of the blowpipe, the hose coupling nut and the hose coupling nipple. The sizes standardized are ⅜ in B.S.P., ¼ in B.S.P., and ⅛ in B.S.P., and the range of reducing hose couplers for connecting unequal sizes of hose comprises ⅜ in.—⅜ in., ⅜ in.—¼ in., ¼ in.—¼ in. The Standard includes line drawings of the fittings covered together with full tables of dimensions.

British Standard Specification for Microfilm, Readers, and Reels. BS 1371: 1947:

London, British Standards Institution. 2/-

This standard was produced in co-operation with the American Standards Association. It covers 16 and 35 mm. microfilm, readers, and reels for processed microfilm. It specifies the stock to be used, the dimensions, the method of winding, the leader, trailer, and title frame, and the arrangement of the images on the film and the correct sequence of pages to ensure convenient reproduction. For microfilm readers, the essential dimensions are prescribed, as well as the other features necessary for satisfactory reproduction, including the type of lens and magnification and the temperature of the film in the gate. The last section specifies the dimensions and features of reels for housing processed microfilm.

British Standard Specification for Metal Lathing (Steel) for Plastering. BS 1369: 1947.

London, British Standards Institution. 1/.-.

This standard covers five types of mild steel lathing—plain expanded, ribbed expanded with ribs forming an integral part of the expanded sheet, ribbed expanded with ribs attached subsequent to expansion of the sheet, perforated, and dovetailed. Methods of construction are specified for each type and there are general clauses covering material, size of mesh, minimum weight of sheet, and tolerances on size and weight of sheet.

British Standard Specification for Reinforced Diamond Dies for Wire Drawing. BS 1393:1947.

London, British Standard Institution. 2/6-.

This standard is a companion to BS 1168:1944, and relates to reinforced dies with bores up to 0.06 inches diameter. It indicates the desirable characteristics of the stone and defines the appropriate minimum wall thicknesses and minimum weights for various bores. It provides for three grades of finish of the hole; it prescribes the dimensional accuracy; and notes the methods of examining and measuring the bores. There are two appendices, giving detailed large-scale diagrams of typical profiles of die bores for drawing copper, bronze, resistance, steel, and tungsten wires; and the dimensional characteristics of commercially graded stones and the requirements which are laid down in the specification.

British Standard Specification for Steel Tubes and Tubulars Suitable for Screwing to B.S. 21 Pipe Threads. BS 1387:1947.

London, British Standard Institution. 2/6-.

This standard applies to welded and seamless, screwed and socketed, and plain end, tubes from ⅛ in. to 6 in. nominal bore, with corresponding tubulars. It prescribes the quality of material and workmanship together with hydraulic, bend, and flattening tests on the tubes and mechanical expansion tests on the sockets. Requirements are also included in regard to the quality of the galvanizing, identification marking and packing, and full tables of dimensions, tolerances, and weights are given for the three classes of tube. These classes are a new light-weight tube, a tube of the same thickness as the gas (light) tube of BS 789:1938, and a tube of the same thickness as the steam (heavy) tube of BS 789:1938. This new standard is a revision of 789 and 789A, and has been prepared to meet the needs of post-war industry.

Ferrous Metallurgical Design; Design Principles for Fully Hardened Steel:

John H. Hollomon and Leondard D. Jaffe. N.Y., Wiley, c1947. 346 pp., illus., 9½ x 6 in., cloth, $5.00.

This is a presentation of the modern viewpoints and scientific principles that can be applied to the selection of steels and to the understanding of their mechanical properties. The design of steels for most purposes should be based upon a knowledge of the transformations that occur in steel, of the mechanical behaviour of metals, and of the flow of heat during heat treatment. This book is an attempt to assimilate some of the new scientific principles that can be applied to metallurgical processes and to the behaviour of metals. It is intended for industrial and ordnance metallurgists, advanced students in metallurgy, metallurgical designers and materials engineers who must obtain optimum mechanical properties in steels.

The following notes on new books appear here through the courtesy of the Engineering Societies Library of New York, and may be consulted at the Institute Library.

CIRCUITS and MACHINES in ELECTRICAL ENGINEERING:

Vol. 1—Circuits, 367 pp.
Vol. 2—Machines, 370 pp.

J. O. Krachenbuehl and M. A. Faucett. 2 ed. John Wiley & Sons, New York; Chapman & Hall, London, 1947, illus., diagrs., charts, tables, 9½ x 6 in., cloth, $4.25 each vol.

Written primarily for non-electrical engineering students, this volume may also be used as a first course for those who are starting in the electrical engineering field. This second edition represents a revision and an expansion of the original book. Now presented in two volumes, one deals with circuits, the other with machines. Additional material on electronics has been added as well as data on transformers. The material on machines has been greatly revised. Features of this book are a unified treatment of alternating and direct current, a wealth of illustrative figures, and new problems.

CONTROL CHARTS, an Introduction to Statistical Quality Control:

E. S. Smith. McGraw-Hill Book Co., New York and London, Toronto, 1947, 161 pp., diagrs., charts, tables, 9¼ x 6 in., cloth, $3.00.

Providing a simple, non-mathematical introduction to the methods and charts of statistical quality control, this volume presents the material with emphasis on practical applications. The first chapter stresses the importance of statistical methods. Chapter II deals with frequency curves and their use in analyzing statistical data. The charts are to be found in chapters III and IV, while chapter V is devoted to formulas used in previous discussions. Features of this book are a new method of determining satisfactory location of control limits with respect to specification limits and a labor-saving table for computing control limits for a chart of fraction derivatives.

ECONOMIC SURVEY OF THE MINING INDUSTRY IN NORTHWESTERN QUEBEC, September, 1946.

Montreal Board of Trade, Mines and Natural Resources Section. 1946. charts, maps, tables, 11¼ x 8½ in., fabrikoid, $10.00.

Considering the mining industry to be the most suitable and worthwhile field for expansion at the present time, this survey examines one important segment as a source of employment and income in the postwar period. Points considered are the productive capacity and its stimulation; the industry as a market for equipment, machinery, etc.; general regional development; and a special chapter on the significance of gold in economic affairs. A statistical appendix gives important figures on all these points.

ELEMENTARY NUCLEAR THEORY:

H. A. Bethe. John Wiley & Sons, New York; Chapman & Hall, London, 1947. 147 pp., diagrs., charts, tables, 8¾ x 5½ in., cloth, $2.50.

Since the volume contains only selected topics in the theory of atomic nuclei, it is not intended as a text for the entire theory but rather an introduction for students and scientists who are not specialists in the study of nuclear physics. Emphasis is placed on the problem of nuclear forces, and the treatment is entirely from the empirical point of view. The available evidence on nuclear forces is presented from the behavior of the simplest nuclear systems. Purely theoretical considerations, such as the meson theory, are treated briefly. The theories of beta disintegration and the compound nucleus are discussed. The theory of the fission process and the theory of nuclear systems are omitted as special phenomena. An appendix contains a table of nuclear species giving the isotopes of the elements, their abundance, and products of disintegration.

HOT-WATER HEATING AND RADIANT HEATING AND RADIANT COOLING:

F. E. Giosecke, New Braunfels, Texas, 1947. Apply to author or Technical Book Co., 110 E. 9th St., P.O. Box 62, Austin, Texas. 283 pp., illus., diagrs., charts, tables, 9¼ x 6 in., cloth, $4.00.

This practical work is chiefly concerned with actual design and installation procedures for particular types and cases of hot-water heating, radiant heating, and radiant cooling. All necessary graphs and calculations are included and illustratively used. Separate chapters are devoted to the heat requirements of buildings, heat emission of radiators, panels, etc., distinctions between open and closed systems, district heating, and radiant heating and cooling fundamentals.

MATERIALS of INDUSTRY, their Distribution and Production.

S. F. Mersereau. 4th ed. revised by C. G. Reen and K. L. Holderman. McGraw-Hill Book Co., New York and London, Toronto 1947. 623 pp., illus., diagrs., maps, tables, 8¼ x 5½ in., cloth, $2.80.

Filling the need of the high school and the technical school for a more systematic study of the common materials of industry, this volume aims to give the student a logical working knowledge of these materials and the industrial processes by which they are produced. Emphasis is placed on raw materials, their distribution and production, as well as their general properties, transportation, conversion into commercial forms, and their

(*Continued on page 640*)

PRELIMINARY NOTICE

of Applications for Admission and for Transfer

December 20th, 1947

The By-laws provide that the Council of the Institute shall approve, classify and elect candidates to membership and transfer from one grade of membership to a higher.

It is also provided that there shall be issued to all corporate members a list of the new applicants for admission and for transfer, containing a concise statement of the record of each applicant and the names of his references.

In order that the Council may determine justly the eligibility of each candidate, every member is asked to read carefully the list submitted herewith and to report promptly to the Secretary any facts which may affect the classification and selection of any of the candidates. In cases where the professional career of an applicant is known to any member, such member is specially invited to make a definite recommendation as to the proper classification of the candidate.*

If to your knowledge facts exist which are derogatory to the personal reputation of any applicant, they should be promptly communicated.

Communications relating to applicants are considered by the Council as strictly confidential.

The Council will consider the applications herein described at the January meeting.

L. AUSTIN WRIGHT, General Secretary

*The professional requirements are as follows:—

A **Member** shall have been engaged in some branch of engineering for at least six years, which period may include apprenticeship or pupilage in a qualified engineer's office or a term of instruction in a school of engineering recognized by the council. In every case a candidate for election shall have held a position of professionl responsibility for at least two years. The occupancy of a chair as professor, assistant professor, associate professor or lecturer in a faculty of applied science or engineering, shall be considered as professional responsibility.
Every candidate who has not graduated from a school of engineering recognized by the council shall be required to pass an examination as prescribed by council, on the theory and practice of engineering, with special reference to the branch of engineering in which he has been engaged.

A **Junior** shall have been engaged in some branch of engineering for at least four years. This period may be reduced to one year, if the candidate for election has graduated from a school of engineering recognized by the council, in which case he shall not remain in the class of Junior beyond the end of the eighth year after graduation.

Every candidate who has not passed the examinations of the third year in a school of engineering recognized by council shall be required to pass an examination in engineering science as prescribed by council. He shall not remain in the class of Junior beyond age thirty.

A Junior may be transferred to Member without payment of transfer fee providing he makes application before the end of the seventh year after graduation or, if a non-graduate, before attaining age twenty-nine, and his application is approved by council.

Council may extend the above limits if in its opinion special circumstances warrant such extension.

A **Student** shall be at least seventeen years of age, and shall present a certificate of having passed an examination equivalent to the final examination of a high school, or the matriculation of an arts or science course in a school of engineering recognized by the council or shall be required to write examinations as prescribed by the council.
He shall be:

a. pursuing a course of instruction in a school of engineering recognized by the council, in which case he shall be transferred to Junior automatically without payment of transfer fee in the second January after graduation, or

b. receiving a practical training in the profession in which case he shall be transferred to Junior without payment of transfer fee providing he makes application before attaining age twenty-five and his application is approved by council.

He shall not remain in the class of Student after he has attained the age of twenty-five, unless in the opinion of council special circumstances warrant the extension of this age limit.

An **Affiliate** shall be one who is not an engineer by profession but whose pursuits, scientific attainments or practlal experience qualify him to co-operate with engineers in the advancement of professional knowledge.

The fact that candidates give the names of certain members as reference does not necessarily mean that their applications are endorsed by such members.

FOR ADMISSION

DAVIS—HAROLD MILBURN, of Montreal, Que. Born at Liverpool, England, June 24, 1911. Educ.: Naval Arch., Newcastle Tech. Coll., 1936; Advanced Naval Arch. & Applied Science, Royal Naval Coll., Portsmouth, Eng.: with Swan, Hunter & Wigham Richardson Ltd., Newcastle, as follows: 1930-37, ind. apprent., 1937-40, jr. naval arch.: 1940-44, R.N. and R.C.N. Sub. Lieut., and finally Lieut. Cmdr., R.C.N., 1940-41, active service, 1942, instructor maths., naval arch. & ship constrn., H.M.S. King's (Dalhousie), 1944, Sr. Naval Officer, R.C.N., Botwood, N'fld.; 1944-47, asst. to naval arch. & estimator, marine dept., Canadian Vickers Ltd., Montreal: 1947 to date, engrg. & arch. dept., Canadian Industries Limited, Montreal, Que. (Asks for admission as Affiliate).

References: A. B. McEwan, C. H. Jackson, I. T. C. Larnder, B. A. Evans, P. F. Stokes.

DAVIS—PAUL TRUEMAN, of Halifax, N.S. Born at Petite Riviere, N.S., March 16, 1919. Educ.: 2 yrs. science at Acadia Univ., 1934-36; with Halifax Shipyards Ltd., as follows: 1939-41, mach. apprent. in ship repair, 1941-43, apprent., dftsman. on destroyer constrn., 1943-46, asst. plant engr., all necessary drafting, supvrn. plant mtce. and new plant constrn.—660 H.P. oil fired central heating plant, (during period, instructor at N.S. Tech. Coll., evening classes in sheet metal dftng., and at Halifax Shipyards Ltd., course in steel ship constrn.), 1946 to date, supt. of mtce., mtce. all plant mach., cranes, locomotives, galvanizing, plate ship and machine shop equipt., etc., Halifax, N.S.

References: W. P. Bickle, S. J. Montgomery, E. H. Henderson, R. W. McColough.

DAWSON—HOWARD DAY, of Victoria, B.C. Born at Faversham, Eng., June 2, 1886. Educ.: Polytechnic Institute, Regents St., London, 1904-1908; R.P.E., British Columbia; M., C.I.M.M.; 1902-04, shop work, Wm. G. Dawson & Sons, Faversham, Eng.; 1904-08, dftsman. & surveyor, A. W. Osborn, London, Eng.; 1908-09, clerk of works, T. Creaton & Co., London & France; 1909-10, dftsman. surveyor, private practise in England; 1911-1914, dftsman., surveyor & designer, M. L. Gordon, Vancouver; 1916-17, Army, accounting; 1917, Consolidated Mining & Smelting Co.; 1917-20, surveyor & underground engr., Britannia Mining & Smelting Co.; 1920-39, private practise as surveyor, civil & mining engr., inclu. municipal engrg. for Kaslo & Nelson; 1939, asst. city engr., Nelson, B.C.; 1939-47, city engr., Nelson, B.C.; and at present, municipal engr., Corp. of District of Saanich, B.C.

References: A. D. Creer, A. S. G. Musgrave, E. Smith, R. Pollard, R. E. Potter, W. J. Tindale, A. C. R. Yuill.

DURDAN—FREDERICK SMITH, of Niagara Falls, Ont. Born at Niagara Falls, N.Y., Feb. 10, 1910. Educ.: B.Sc., (Civil), Queen's, 1933; R.P.E., Ontario; 1929-30, (summers), H.E.P.C. of Ontario; 1934, (9 mos.), Norton Co., Chippawa, Ont.; 1939-42, asst. supt. i/c prod. mtce., and all plant operations; 1943-46, asst. works mgr. i/c prod., mtce., etc.; 1947 to date, field engr., The Carborundum Co., Niagara Falls, N.Y.

References: W. D. Bracken, W. Jackson, J. A. Vance, F. T. Julian, D. S. Ellis, C. Climo, M. F. Ker.

ESKINAZI—BENO, of Montreal, Que. Born at Corlu, Turkey, June 1, 1926. Educ.: B.Sc., (Civil), Robert College (Istanbul American College), 1946; Applied Maths., Sorbonne, 1946-47; 1947, research in laminated wood products; F. A. Akoun, Bois Soude, Gaillon, Eure, France; dftsman. in strucl. steel, A. Bruynell, Bureau d'Etudes, Paris; reinforced concrete, design practice, Marcel Reimbert, consultg. engr., Paris; at present, graduate studies in structl. engrg. at McGill Univ.; part-time engagement with Truscon Steel Co., Montreal, Que.

References: R. E. Jamieson, G. J. Dodds, B. Gersovitz, F. R. Murray, J. J. O'Neill.

FERGUSON—JOHN MCWILLIAM, of Golden, B.C. Born at Kamsack, Sask., Sept. 30, 1923. Educ.: B.Sc., (Civil), Saskatchewan, 1946; 1943, time checker, checking men & equipt. on 20-mile section twice daily, in constant contact with problems and feats in bldg. such a road—Alaska Highway; 1945, instru'man., running levels and cross-sectioning, Sask. Dept. of Highways; 1946 to date, tech. officer, grade I, running instrument on topographic survey, i/c camp, and constrn. crew, erecting permanent and temporary gauge houses and cable crossings, Dominion Water & Power Bureau, Vancouver, B.C.

References: E. K. Phillips, I. M. Fraser, R. A. Spencer, C. R. Forsberg, N. B. Hutcheon.

FORGET—JEAN MAURICE, of Montreal, Que. Born at Labelle, Que., Sept. 19, 1900. Educ.: B.A.Sc., C.E., Ecole Poly., 1926; R.P.E., Quebec; 1926-27, Geodetic Survey, Ottawa; 1928 to date, Montreal Tramways Company, plan, profile and layout of special trackwork, general office work, and at present, engr. of special track work, Montreal, Que.

References: A. Duperron, J. Archambault, J. P. Lalonde, J. E. Chagnon, P. Lebel.

GILLESPIE—PETER MERRITT, of Montreal, Que. Born at Toronto, Ont., Sept. 14, 1922. Educ.: B.A.Sc., (Mech.), Toronto, 1945; R.P.E., Ontario; 1945, (6 mos.), jr. engr., R. A. Hanright, consultg. engr.; 1945-46, estimating engr., Link Belt Ltd.; 1946 to date, project engr., responsible for design and erection of air conditioning systems, Dominion Textile Co., Ltd., Montreal, Que.

References: E. B. Jubien, H. S. Weldon, R. H. Hobner, G. L. Wiggs, C. R. Young, C. F. Morrison.

HUGHES—ROGER CAULDWELL, of Courtenay, B.C., Born at Comox, B.C., Dec. 22, 1923. Educ.: B.A.Sc., (Chem. Engrg.), British Columbia, 1947; 1943-44-45-46-47, (summers), survey crew, Dept. of Transport; asst. to B.C.L. surveyor; instru.'man., H. G. Acres & Co. Recently completed summer employment with H. G. Acres & Co., (consultg. engrs.) at Campbell River project, B.C.

References: T. M. MacIntyre, J. N. Finlayson, A. Peebles, H. V. Serson.

ILOTT—ERIC CHARLES, Capt., R.C.E.M.E., of Kingston, Ont. Born at London, Eng., Nov. 12, 1919. Educ.: B.Sc., (Eng.), Univ. of London; A.M., Inst. of E.E.; 1940, (summer), vacation apprent. for 3 mos., Radio Transmission Equipment; Ltd., London; with British Army, as follows: 1941-44, Tech. Staff Officer, responsible for mtce. of radar instlns. N.E. and South London, tech. control of some ten to twenty Radio Mtce. Officers and 100 mechanics; 1944-46, British Army Staff, Washington, D.C., responsible for tech. liaison with U.S. & Canadian Armies and Canadian mfrs., initially as a Captain concerned with radio equipts., and subsequently as Major (Deputy Asst. Director of Mechanical Engrg. Telecommunications) covering all electronic equipt.; 1946-47, Instructor in Radio & Television Engrg., E.M.I. Institute Ltd., Chiswick, London; and at present Capt. Canadian Army, Instructor, R.C.E.M.E., Barriefield, Ont.

References: C. E. Craig, W. S. Hunt, A. O. Monk, G. W. Thomson, G. W. Holbrook, W. Alton, I. M. McLaughlin.

LEMISKI—WALTER, of Terrace Bay, Ont. Born at Fort William, Ont., March 6, 1923. Educ.: B.Sc., (Mech.), Queen's, 1946; with Canadian Car and Foundry Co., Ltd., Fort William, Ont. as follows: 1941-42, lead hand in prod. dept., 1942-43. tool and die maker, 1944, (5 mos.), 1945, (5 mos.), intermediate dftsman.; 1946 to date, jr. engr., Long Lac Pulp & Paper Co., Terrace Bay, Ont.

References: J. E. Isbester, R. E. Williams, B. J. McColl, D. S. Ellis, A. Jackson.

McGILL—DONALD RUSSELL, of Calgary, Alta. Born at Calgary, Alta., April 17, 1920. Educ.: B.Sc., (Elect.), Alberta, 1947; 1939, (summer), surveying, airport, Dept. of Transport; 1940, (summer), student apprent., meter transformer Dept. Calgary Light & Power: 1941, (summer), meter reader. Calgary Light & Power: 1942-45, Lieut., Canadian Army; 1946-47, asst. illumination design engrg., Calgary Light & Power; at present, jr. engr., engrg. dept., Canadian Utilities Ltd., Calgary, Alta.

References: R. M. Hardy, L. A. Thorssen, J. G. MacGregor, J. C. Dale, J. N. Ford, R. MacKay.

McLEOD—JAMES DOUGLAS, of Vancouver, B.C. Born at Vancouver, B.C., January 11, 1916. Educ.: B.A.Sc., (Civil), British Columbia, 1939; 1938-39-40, (summers), instru'man., Water Rights Branch, Dept., of Lands, Victoria: 1941, engr. Grade No. 1, Dominion Water & Power Bureau; 1941-43, R.C.E., 2nd/Lieut., then lieut.; with Dominion Water & Power Bureau, as follows: 1943-46, engr. civil, Grade No. 2, asst. to office engr., supervising hydrometric activities in B.C., and acting for office engr. in his absence, 1946 to date, engr. civil, Grade No. 3, supervising hydrometric and allied activities in B.C. (during the winter sessions, 1939-40 and 1940-41, employed as laboratory instructor in hydraulics and field instructor in surveying practise classes, Univ. of B.C.).

References: C. E. Webb, V. M. Meek, R. C. Farrow, S. H. Frame, J. N. Finlaysin, A. Peebles, W. H. Powell.

McMURRAY—MacKENZIE, of Toronto, Ont. Born at Toronto, Ont., April 7, 1915. Educ.: B.A.Sc., Toronto, 1939; R.P.E., Ontario; 1934-39, (summers), lab. asst., Canadian National Carbon Co., Toronto, Ont.; 1939-40, demonstrator, Univ. of Toronto; 1940-41, asst. metallurgist, munitions divn., Dominion Bridge Co., Toronto; 1941, (6 mos.), asst., glass eye development, Dept. of Pensions & National Health, Christie St. Hospital, Toronto; with Dominion Bridge Co., Ltd., as follows: 1941-45, munitions divn., Toronto, Ont., 1945-46, structl. design asst., Toronto, 1946-47, boiler design asst., Lachine, Que., and at present, sales engr., combustion divn. Toronto, Ont.

References: W. H. M. Laughlin, R. S. Eadie, E. R. Graydon, G. P. Wilbur, G. N. Martin, W. J. Wright, C. H. Timm.

MURTON—JAMES HENRY, of Calgary, Alta. Born at Crossfield, Alta., Aug. 16, 1911. Educ.: Petroleum Engr., Colorado School of Mines (accredited E.C.P.D.); 1941-42, design engr., Gas & Oil Production Ltd.; 1942 to date, plant (office) engr., Imperial Oil Limited, Calgary, Alta.

References: J. J. Hanna, F. Tempest, F. L. Perry, A. A. Peebles, G. W. Webster, K. W. Mitchell.

NARRAWAY—MAXWELL LANE, of Ottawa, Ont. Born at Ottawa Ont., July 25, 1925. Educ.: B.Sc., (Elect.), Queen's, 1947; 1944, (summer), Geodetic Survey of Canada, asst. surveyor; with Bell Telephone Co. of Canada, as follows: 1945, (summer), transmissions engrg. dept., 1946, (summer), plant dept., and at present, plant dept., Ottawa, Ont.

References: D. M. Jemmett, D. S. Ellis, S. D. Lash, L. F. Grant G. R. Turner, J. L. Sbearer.

PUGH—JAMES GILLESPIE BLAINE, of Fredericton, N.B. Born at Marysville, N.B., June 5, 1892. Educ.: B.Sc., (Civil Engrg.), New Brunswick, 1915; 1910-14, (summers), chainman, prelim. rly. survey, N.B. Gov't.; dftsman., St. John & Quebec Rly.; topographer, prelim. rly. survey, Aroostook Co., Maine; 1915-17, dftsman. i/c forestry dftng. office, topographical survey, N.B. Rly. Co., Saint John; 1917 to date, asst. chief dftsman., Department of Lands and Mines, Province of N.B., Fredericton, N.B.

References: C. A. MacVey, E. O. Turner, A. F. Baird, G. R. Turner, J D. MacKay, C. D. McAllister.

ROBERTS—STANLEY OXLEY, of Ottawa, Ont. Born at Cleckheaton Eng., July 16, 1889. Educ.: Tech. School, Cleckheaton, Eng., 1907-1909; Nova Scotia Tech. Coll., 1917-18; 1912-13, rodman, survey party; 1916-19, Wireless Tech. officer; 1920-24, jr. engr., Geodetic Survey of Canada; 1924-32, asst. engr., Dept. Interior; 1932-40, sr. asst. engr., Penitentiary Br., Dept. Justice; 1940-42, Dept. Transport, B.C.A.7.).; 1942-44, Major, Signals; 1944 to date, sr. asst. engr., Dept. Mines & Resources, Engrg. & Construction Service, Ottawa, Ont.

References: J. M. Wardle, T. S. Mills, J. N. Stinson, V. M. Meek, G. H. Turner.

WINGATE—THOMAS RODERICK, of Montreal, Que. Born at Peachland, B.C., Feb. 26, 1913. Educ.: Heriot-Watt Coll., Edinburgh, 1932-38; Higher National Certificate, (Mech. Engrg.), 1938; A.M., Inst. M.E.; A.F., Royal Aero. Society; R.P.E., Quebec; 1932, asst. engr., M.V. Pacific Trader; with MacTaggart Scott & Co., Edinburgh, as follows: 1932-37, engr. apprent., 1937-39, engr. dftsman; 1939-40, tech. asst., Bristol Aeroplane Co.; with Dowty Equipment, as follows: 1940, tech. asst., Cheltenham, Eng., 1940-42, tech. sales mgr., Montreal, 1942-43, genl. manager, 1943 to date, vice-pres. & genl. mgr., (Dowty Equipment (Canada) Ltd., designers & mfrs. of aircraft landing gear & hydraulic equipt.).

References: E. G. MacGill, D. Boyd, R. N. Dobson, T. C. McConkey, J. A. T. Butler, R. B. Douglas.

FOR TRANSFER FROM THE CLASS OF JUNIOR

ANDERSON—PAUL, of Toronto. Born at Toronto on May 16, 1916. Educ.: B.A.Sc. (Elec.) Toronto 1939. R.P.E. Ontario; 1939-40, sales engr. Ferranti Electric Ltd.; with the R.C.E.M.E. Corps as follows: 1940-41, Lieut.-O.M.E. 4th Cl. Camp Borden; 1941, M.T. Workshop St. John, N.B.; 1942-43, ordnance Workshop; 1943-44, Adjutant, HQ Cdn. Inf. div. 2-i/c Cdn. armoured Bde. Wksp.; 1945- 2-i/c CREME first Cdn. army Tps.-Major; at present, elect. engr., Canada Electric Ltd., Toronto, Ont. (St. 1939. Jr. 1946).

References: I. Widdifield, C. F. Morrison, H. Self, E. R. Graydon.

BESTWICK—FRANK SHELDON of St. Catharines, Ont. Born at Winnipeg, Man. on Nov. 10, 1916; Educ.: B.Sc. (Elec.) Manitoba, 1940; R.P.E. Ontario; 1940-41, elect. material engr., Fraser Brace Engineering Co.; with Defence Industries Ltd. as follows: 3 mos. junior engr. on general constrn.; 5 mos. engr. on electrical constrn.; 3 mos. on loan to Angus Robertson Ltd. as asst. to Elect. Supt.; 8 mos. D.I.L.-C.I.L. Head Offices; engr. responsible for elect. material take-offs & purchase orders; 9 mos. elect. mtce. D.I.L. Montreal Works; 1944, asst. Elect. supt. Bathurst Power & Paper Co.; 1944 to date, application engr., English Electric Co. of Canada Ltd. (St. 1940. Jr. 1946).

References: J. R. Auld, G. A. Cunningham, J. B. Eldridge, H. C. Karn, A. G. Moore

COLLET—MARC A. of Montreal, Que. Born at Montreal, on April 25, 1922. Educ.: B. Eng. (Chem.), McGill, 1944; R.P.E. Quebec; 1944-46, tech. control, Dominion Rubber Company; 1946 to date, mgr. Liquid Steel Paint Products Co. Ltd., Montreal. (St. 1944. Jr. 1946).

References: R. DeL. French, J. A. Coote, E. Brown, C. G. McKergow.

DAVEY—ROLAND ERIC of Toronto, Ont. Born at Meaford, Ont. Nov. 25, 1913. Educ.: B.A.Sc. (Civil) Toronto 1935; R.P.E. Quebec; 1935-37, field clerk & asst. engr. Dufferin Paving Co. Ltd.; 1937-39, engr. dftsman. instru'man Hydro-Electric Power Commission of Ontario; 1939-40, Jr. engr. Dept. of Public Works (Canada); 1941-45, resident engr. Shelburne Naval Base, Works & Buildings branch, Naval Service; 1946-47, operations mgr., Montreal Div. and Marine Terminal Constrn. Engr., Canadian Oil Company Ltd. (St. 1935. Jr. 1942).

References: R. T. Eyre, F. Alport, A. J E. Smith, W. L. Fraser, E. G. Tallman, C. R. Young.

DUNN—RUSSELL ARTHUR of Montreal. Born at Montreal on June 14, 1916 Educ.: B.Eng. (Metallurgy) McGill 1938; summer work 1936, engineering material at Dominion Steel & Coal; 1937, Consolidated Mining & Smelting with Canadian Liquid Air Co. Ltd. as follows: 1938-40, field engr.; 1941-43, district engr. & asst. district mgr. development & engineering dept. i/c of industrial appl.; at present General Sales Manager; (St. 1939. Jr. 1944).

References: J. R. Stewart, F. W. Cooper, F. G. Kerry, G. Cape, R. E. Jamieson, C. Whittemore.

HALDANE—DONALD EDWARD of Hamilton, Ont. Born at Canwood, Sask. on July 11, 1917; Educ.: B.Sc. (Mech.), Saskatchewan, 1942; From June 1942 to May 1945, in the R.C.E.M.E. Cdn. Army, served in England and continental Europe with rank of Lieut.; June 1945-Oct. 1947, design engr. i/c of product design of Harvest Tools for Int. Harvester Co., Hamilton, Ont. (Jr. 1944).

References: N. B. Hutcheon, I. M. Fraser, R. A. Spencer, E. K. Phillips, A. L. C. Atkinson, W. E. Lovell.

KRAFT—ROBERT WILLIAM of Arvida, Que. Born at Kitchener, Ont. on July 2, 1919. Educ.: B.Sc. 1940 and M.Sc. (Chemistry) 1941, Queen's University; R.P.E. Quebec; with Aluminum Company of Canada Ltd., Arvida, Que. as follows: 1941, 4 mos. study of plant process control & operation, 3 mos. supervisor, contrn. & operation of chemical pilot plant; Jan. 1942-Mar. 1943, Aluminum Laboratories Ltd., Kingston, Ont., research analyst, responsible for all chemical analyses, and some chemical research; Apr. 1943-Dec. 1945, chemist, doing research & investigation on carbon electrode mfg.; Nov. 1943-Jan. 1944, supervisor, constrn. and operation of chemical pilot plant; Jan. 1946-July 1946, chemist Aluminum Laboratories; Aug. 1946-Nov. 1946, engr. asst. development work in connection with power sales; Nov. 1946-Mar. 1947, asst. to project engr. constrn. of electrolytic plant Arvida; Mar. to date 1947, development engr. Arvida. (St. 1941. Jr. 1945).

References: M. Dubose, P. E. Radley, A. C. Johnston, R. H. Rimmer, E. F. Hartwick, A. Jackson.

LINDSAY—DONALD LORNE of Montreal, Que. Born at Quebec City on March 23, 1918. Educ.: B.Eng. (Mech.) McGill 1941; R.P.E. Que. 1941 joined R.C.N.V.R; 1942-43, Engr. Officer (Lieut.) with Royal Navy as watch keeping officer; 1943-45, O/I gun mountings mtce. design, inspection, manufacture, Naval Service H.Q.; 1945-47, mech. engr. in heating and ventilating design, G. Lorne Wiggs & Co. (Jr. 1942).

References: G. Lorne, C. McKergow, C. Craig, L. C. Jacobs, J. G. Frost, E. P. Muntz, W. W. Timmins.

LOUCKS—GEORGE IRVIN of Calgary, Alta. Born at Invermay, Sask. on June 7, 1921. Educ.: B.Sc. (Mech.) Saskatchewan, 1943. 1943-45, Lieut. (E) R.C.N.V.R. chief engr. of Frigate; 1945-46, demonstrator, stm. power, University of Saskatchewan; 1946 to date, lubrication engrg., (selling), McColl Frontenac Oil Co. Ltd. (St. 1943. Jr. 1946).

References: I. M. Fraser, N. B. Hutcheon, R. A. Spencer, E. K. Phillips, J. S. Neil, A. L. C. Atkinson.

McQUIRE—RALPH DOUGLAS of Arvida, Que. Born at Kingston, Ont. on Sept. 4th, 1917. Educ.: B.Sc. Queen's 1940; with International Nickel Co. Ltd., Copper Cliff, Ont. as follows: 1940, development engr., smelter and concentration; 1940-41, development engr. Copper Refinery, Aluminum Co. of Canada Ltd., Arvida; 1941-42, control engr. Ore Plant No. 1; 1942-43, calcination engr. Ore Plant No. 2; 1943-47, hydrate dept. supervisor—Ore Plant No. 2; 1947, asst. supt. Ore Plant No. 1, production & quality supervision in Hydrate Dept. of Bayer Ore Plant, responsible for operation mtce; co-ordination, material and supply scheduling, Arvida, Que. (Jr. 1945.)

References: H. R. Fee, F. T. Boutilier, G. M. Mason, F. A. Dagg, G. A. Antenbring.

MAGNAN—MAURICE J. of Montreal, Que. Born at Vaucluse, Que. on Jan. 15, 1917; Educ.: B.A.Sc. (C.E.) Ecole Polytechnique, 1943; R.P.E. Quebec: with St. Clair Processing Corporation Sarnia as follows: 1943-44, erecting supervisor; 1944-45, mtce.; 1945, engineer; 1945-46, production engr; Eagle Pencil Co. of Canada, Drummondville, Que.; 1946 to date, engineer, Imperial Oil Ltd., Montreal, (St. 1941. Jr. 1945)

References: A. C. Harrop, C. Scrymgeour, C. W. E. Miles, R. W. Dunlop, H. Audet, H. Gaudefroy, G. L. MacPherson.

MANN—GORDON CHARLES of Red Rock, Ont. Born at Tessier, Sask. on Feb. 8, 1919. Educ.: B.Sc. (Mech.) Saskatchewan, 1941; R.P.E. Ontario. 1941-42, resident inspector for Federal Govt. at Sicard Ltd. Montreal, supervising the Assembly of 5-ton trucks; 1942-44, dftsman. power plant layout, Aluminum Co.; 1944-46, engrg. sales, Canadian Allis Chalmers; at present, asst. plant engr. Brompton Pulp & Paper Co., Red Rock, Ont. (St. 1941. Jr. 1946).

References: R. W. Emery, C. G. Southmayd, J. N. DeStein, I.. M. Fraser

MILHAUSEN—WILLIAM JAMES of Brandon, Manitoba. Born at Moose Jaw, Sask. on Jan. 10, 1918. Educ.: B.Sc. (C.E.) Manitoba, 1940; R.P.E. Manitoba; 1940-dftsman. surveys branch, Dept. of Mines & Natural Resources. 1941-45, Capt. R.C.E. and 2 i/c 3rd. Field Coy.; 1945-46, resident engr. Highways branch legislative buildings, Winnipeg; 1946-47, asst. district engr. Highways Branch, Boissevain, Man.; 1947 to date, asst. district engr. Highways Branch, Brandon, Man. (St. 1940. Jr. 1946).

References: G. B. Williams, W. H. Hunt, G. H. Herriot, A. E. McDonald, W. F. Riddell.

SMITH—OWEN LEONARD of Riverbend, Que. Born at Twillingate, Nfld. on Aug. 25, 1910. Educ.: B.Eng. (Elect.) Nova Scotia Technical College, 1939; R.P.E. Quebec; 1940, dftsman. Metropolitan Electric Co.; April 1940-April 1941; dftsman. Canadian Comstock Co.; 1941-42, supt. electrical heating & plumbing installations Gaspe Defence Met. Elec. Company; 1942-43, estimator, Met. Elec. Co.; 1943-44, dftsman. Std. Bill of Material Committee; March 1944-Dec. 1944, dftsman. Anglo Can. Shipbuilding Div.; 1945 to date, elect. engr. Price Bros., Riverbend, Que. (St. 1935. Jr. 1938).

References: D. S. Estabrooks, E. Cowan, A. D. Ross, A. B. Sinclair, H. O. McInerney.

SWEENEY—JOHN BARTHOLOMEW of Montreal, Que. Born at Hazenmore, Sask., Feb 11, 1920. Educ.: B. Eng., Saskatchewan, 1941; R.P.E. Quebec; 1941-42, engr. dftsman., Consolidated Paper Corporation; 1942-45, R.C.A.F., Aero. Engr. with Consolidated Paper Corporation, Laurentide Div., Grand' Mère, Que., as follows: 1945-46, asst. to divn. engr., 1946 to date, mech. supt. (St. 1941. Jr. 1943).

References: I. M. Fraser, V. Jepsen, E. T. Buchanan, G. S. G. Henson, G. R. Goring.

VATCHER—CHESLEY HOLMES of Toronto, Ont. Born at Carbonear, Nfld. on June 6, 1917. Educ.: B.A.Sc. (Elect.) Toronto, 1939; R.P.E. Ontario; 1939-40, demonstrator in elect. eng. University of Toronto; 1940-41, sales engr.; 1941-42, tech. correspondent, Canadian National Carbon Co.; 1942-44, R.C.N.V.R. asst. Eng. Officer on H.M.C. Escort Ship; 1944 Technical Officer Personnel, Halifax; 1944-45, Engineer Officer H.M.C. Escort Ship i c machinery, ship mtce.; 1945-47, sales engr., now asst. to mgr., Industrial Products Sales Department Canadian National Carbon Co. Ltd. Toronto. (St. 1938. Jr. 1942).

References: W. A. Devereaux, S. C. Montgomery, R. K. Northey E. E. Robertson, A. Vatcher.

WILCOX—ROBERT BERNARD of Halifax, N.S. Born at Dartmouth, N.S. on March 20, 1921. Educ.: B.Eng. (Elect.) Nova Scotia Technical College; 1944; in the R.C.N.V.R. as follows: 1944, Elec. Lieut. i/c of radar asdic communications & elec. power equipment, mtce. H.M.C.S. Thetford Mines; Nov. 1944—June 1945, high power engr. Torpedo School, H.M.C.S. Stadacona; 1945-46, i c of removing all power and fire control equipt. training from H.M.C. Torpedo School and installing new equipt. for training in H.M.C. Electric School, Halifax; 1946-47, asst. lecturer in servomechanism, Massachusetts Institute of Technology. (Taking master's degree (elec.) majoring in servomechanisms, graduate in June 1948). (St. 1944. Jr. 1946).

References: J. B. Hayes, L. E. Mitchell, D. S. Nicol, S. H. Burchell, H. A. Ripley.

ZION—ALFRED BERNARD of Montreal. Born at Boston, Mass. on Aug. 25, 1913. Educ.: B.Eng. (Mech.) McGill, 1935, R.P.E. Quebec; 1935-36, order chaser, Independent Lock Co. Ltd., with Dominion Lock Co. as follows: 1936-38, asst. production mgr.; 1938, production mgr.; 1942. Tool engr., Montreal Materials Processing Co. (employed in both firms, i/c of operations, Montreal Materials Processing Co. a subsidiary of the aforementioned firm). (St. 1935. Jr. 1941).

References: R. DeL. French, J. A. Coote, E. Brown, C. G. McKergow.

LIBRARY NOTES *(Continued from page 637)*

economic importance. New material on plywood, fiberboard, wallboards, alloy steels, glass, magnesium, synthetic rubber, and plastics has been added in this fourth edition.

POWER SYSTEM STABILITY, Vol. 2, Transient Stability.

S. B. Crary. John Wiley & Sons, New York; Chapman & Hall, London, 1947. 329 pp., illus., diagrs., charts, tables, 8½ x 5½ in., cloth, $6.00.

Treating the theory of stability and its application to system and apparatus design, this volume discusses in detail such factors affecting transient performance as occurrence, type and location of short circuits; response of the system to sudden changes in voltage and current; speed of circuit-breakers and relays; and response of the excitation systems and governors of the synchronous machines. The first six chapters are devoted to methods of analysis; the next three to applications. In the last chapter, the various types of stability are discussed, and an indication is given of the future possibilities of control equipment. A bibliography covers the literature from 1894 to 1946.

TABLES of the BESSEL FUNCTIONS $J_0(z)$ and $J_1(z)$ for COMPLEX ARGUMENTS:

Prepared by the Mathematical Tables Project, National Bureau of Standards. 2 ed. Columbia University Press, New York, 1947. 403 pp., diagrs., 10¾ x 7¾ in., cloth, $7.50.

Presenting 10-place tables prepared by the mathematical tables project of the National Bureau of Standards, this volume covers the functions of $J_0(z)$ and $J_1(z)$ for moduli ranging from 1 to 10 at intervals of 0.01. Contour lines of $J_0(z)$ and $J_1(z)$ are given, as well as a table of Langrangian interpolation coefficients. A bibliography containing 67 references is also included.

TELEVISION, Volume III (1938-1941) 486 pp.

TELEVISION, Volume IV (1942-1946) 510 pp.

Edited by A. N. Goldsmith and others.

RCA Review, Radio Corporation of America, RCA Laboratories Division, Princeton, New Jersey, 1946-1947. Illus., diagrs., charts, tables, 9 x 6 in., cloth, $2.50 each vol.; paper, $1.50 each vol.

Continuing the series of which Vols. I and II appeared in 1936 and 1937, the current volumes III and IV present a selection of technical articles from representative journals in the field. Vol. III covers the period 1938-1941 and is divided into the broad classifications of pickup, transmission, reception and general information. In addition to the articles reprinted in full, there are summaries of several others, as well as summaries of all articles in Vols. I and II. Vol. IV covers the period 1942-1946, has two additional classified sections—color and military television, and includes a bibliography of television articles from 1929 to 1946. For both the complete articles and the summaries, the full reference to the original source is given.

WATKINS CYCLOPEDIA OF THE STEEL INDUSTRY, 1st ed.:

Steel Publications, Inc., 108 Smithfield St., Pittsburgh 30, Pa., 1947. 375 pp., plus 93 pp., Directory and Advertisers Index, illus., diagrs., tables, 11½ x 8¼ in., cloth, $10.00.

This book describes briefly modern procedures as required for performing the operations that are employed in the manufacture of steel, from the treating of iron ores to the handling of the finished product. Such processes as beneficiation, nodulizing, and sintering are discussed. The blast furnace, the open hearth furnace, the bessemer converter, the electric furnace, and the cupola are dealt with. Rolling and shaping of steel, forging and welding of steel, metal finishing and cleaning, and the inspection and testing of steel are mentioned. Statistics on coke, iron and steel are given for the years 1942-1945. Steel plant refractories, carbon and alloy steels, the fabricating of steel and the steel processing furnace are subjects treated. Pictures and descriptions of equipment used in the industry are given, together with the companies from whom the equipment may be obtained. References to the sources of data, a trade directory, and a buyers' guide are included.

WIRELESS DIRECTION FINDING:

R. Keen, 4th ed. "Wireless World" by Iliffe & Sons, Ltd., London, Birmingham, Coventry, Manchester and Glasgow, 1947. 1059 pp., illus., diagrs., charts, maps, tables, 8 x 5 in., cloth, 45s.

Revised to include material on research work done during the war, this volume is intended for use as a manual, not a textbook. Navigation systems using the hyperbolic grid, the design and testing of high frequency radiogoniometers, and transmission line theory as applied to Adcock aerial systems are discussed. The cause and reduction of resonance effects in Adcock aerials and feeders, and H-F finding equipment are considered. A section on calibration has been added and that on beacons has been expanded. Radar is not included. A comprehensive bibliography of over 700 items covers the literature on directive reception and transmission as applied to navigation taken from 75 magazines within the period 1893-1947.

Although not available in the Institute Library, inquiries concerning the following new books will be welcomed there or may be sent direct to the publishers.

AIRCRAFT MATERIALS AND PROCESSES. (Pitman Aeronautical Engineering Series.)

G. F. Titterton, 3 ed. Pitman Publishing Corp., New York and Chicago, Toronto, 1947. 357 pp., illus., diagrs., charts, tables, 9¼ x 6 in., cloth, $4.75.

Essential information on materials and processes used in the construction of aircraft is described from a utilitarian point of view. The data are from government sources and the Handbook of the Society of Automotive Engineers. Definitions of physical terms, heat treatment terms, and physical test terms are given. Steel and its alloys, including corrosion-resisting steels, nickel alloys, copper and its alloys, wrought aluminum alloys, magnesium alloys, wood and glue, fabrics and dope, plastics, transparent materials, rubber and synthetic rubbers are materials with which the book deals. The following processes are also described: testing aircraft materials, heat treatment of steel, surface hardening, shaping of metal, aluminum alloy casting, metal joining processes and corrosion and its prevention. The selection of material for all parts of aircraft is also treated.

ANALYSIS OF RAILROAD OPERATIONS:

J. L. White. Simmons-Boardman Publishing Corp., New York, 1946. 305 pp., illus., diagrs., charts, tables, 9¼ x 6 in., cloth, $5.00.

The statistical and accounting procedures necessary for effective analysis are dealt with in full, with detailed discussion of the character of the revenues and expenses to be considered. The main text concludes with the analysis of actual operations of two Class I railways in 1941, including the tabular presentation of important information. The book is intended to serve a wide field, from the student of railroad transportation to the security analyst, but particularly for railroad executives, accountants, and operating officers. *(Continued on page 644)*

Employment Service

The service is operated for the benefit of members of The Engineering Institute of Canada, and for industrial and other organizations employing technically trained men—without charge to either party. It would therefore be particularly appreciated if employers would make the fullest possible use of these facilities to make known their existing or estimated requirements. Notices appearing in the Situations Wanted column will be discontinued after three insertions, and will be re-inserted upon request after a lapse of one month. Personal interviews by appointment.

Situations Vacant

CHEMICAL

CHEMICAL ENGINEER, recent graduate, required to study and become experienced with industrial products fabricated from carbon or graphite by firm in Toronto area. Position to eventually lead to sales. Salary $180-$200. Apply to File No. 3958-V.

JUNIOR ENGINEER, preferably chemical background, required for Alberta refinery. Duties include plant tests, inspection of equipment and assistance on designs and specifications. Opportunity for supervised training in all phases of refinery operations. Salary open. Apply to File No. 3961-V.

CHEMICAL ENGINEER, recent graduate up, required for the engineering staff of a pulp mill in Eastern Quebec. Salary open. Apply to File No. 3973-V.

CHEMICAL ENGINEER, recent graduate, is needed by a chemical manufacturing firm situated in the Province of Quebec. Some experience in oil refinery, pulp and paper, or synthetic resin manufacture would be useful. Salary open. Apply to File No. 3978-V.

CIVIL

JUNIOR CIVIL ENGINEER with some structural experience, required for general duties by a textile manufacturing concern near Montreal. Salary around $300. Apply to File No. 3954-V.

CITY ENGINEER required by a city in Saskatchewan to take full charge of its utilities which include electric light, power, sewer, water, sidewalks, etc. Salary open. Apply to File No. 3955-V.

GRADUATE CIVIL ENGINEER with some experience in municipal work required as Assistant to the Director of Community Planning of the Province of Saskatchewan. Starting salary $200-$250. Apply to File No. 3957-V.

EXPERIENCED DRAUGHTSMAN required for civil engineering work by a paper company in Eastern Quebec. Duties will include design and details of buildings, dams and miscellaneous structures required in Woodlands operations. Preferably a single man and bilingual. Salary $225-$300. Apply to File No. 3962-V.

CIVIL ENGINEER, recent graduate required to understudy City Engineer of a city in Western Quebec. Salary open. Apply to File No. 3966-V.

JUNIOR ENGINEER, preferably with civil background required for sales and service by a Montreal manufacturer of waterproofing compounds. Salary open. Apply to File No. 3968-V.

CIVIL ENGINEER is required to act as Town Engineer, preferably with municipal experience, in a town in Ontario. General engineering work on sewage, roads, maintenance and planning, also to take charge of all building supervision insofar as compliance with town by-laws. Salary $3,800. Apply to File No. 3986-V.

CIVIL ENGINEER required in Montreal with considerable experience in design of re-inforced concrete and steel structures. Ability to make stability reports of wharves and retaining walls, also draft specifications, prepare estimates and economic studies. Preferably bilingual and veteran with overseas service. Salary not less than $3,480. Apply to File No. 3987-V.

CIVIL ENGINEER, required in Montreal with general knowledge of re-inforced concrete and steel structures. Special knowledge of triangulation, surveys, boundry surveys also laws and procedure to be followed in regard to the purchase, transfer and registration of lands in Province of Quebec. Must be bilingual. Preferably veteran. Salary not less than $3,480. Apply to File No. 3987-V.

CIVIL ENGINEER, age 25 to 40, required by an industrial organization with headquarters in Montreal as Cost Estimator. Minimum 5 years experience as Estimator for contractor or industrial concern. Duties include preparation and subsequent control of cost estimates including building construction, electrical and mechanical process equipment and their installation cost. Salary $300-400. Apply to File No. 3988-V.

ELECTRICAL

GRADUATE ELECTRICAL ENGINEER, aged 28-32, required for sales engineering by an industrial firm specializing in products made of carbon and graphite in Toronto. Experience in plant maintenance or installation work or C.G.E. or Westinghouse test course desirable. Salary $3,000-$3,600. Apply to File No. 3958-V.

GRADUATE ENGINEER, preferably electrical background, with several years in electronic work required by a Montreal manufacturer for engineering sales orders, wiring diagrams, production of electrical instruments and assisting manager. Salary open. Apply to File No. 3971-V.

PROFESSOR IN ELECTRICAL ENGINEERING required for second term, beginning January. Preferably with teaching and practical experience in power, electrical machinery, design, lab. etc. Bilingual preferred. Attractive salary available for right man. Apply to File No. 3982-V.

MECHANICAL

RECENT GRADUATE, mechanical background, required by a manufacturer in Montreal for work in machine design, possibly for production in the future. Salary $225. Apply to File No. 3901-V.

JUNIOR ENGINEERS, preferably with mechanical background, required for general duties by a textile manufacturing concern near Montreal. Salary open. Apply to File No. 3954-V.

JUNIOR MECHANICAL ENGINEER required in Montreal for design and production work. Preferably with knowledge of heating and ventilating. Salary from $250-$300. Apply to File No. 3956-V.

MECHANICAL ENGINEER, recent graduate, with some knowledge of heat exchanges, condensers, or any type of unfired pressure vessels required by an industrial organization in Montreal. Salary open. Apply to File No. 3976-V.

MECHANICAL ENGINEER is needed by a chemical manufacturing plant located in the Province of Quebec. Some experience is desirable, although consideration will be given to very recent graduate. Salary open. Apply to File No. 3978-V.

MECHANICAL ENGINEER, recent graduate, bilingual, with some experience in general plant work, required in Montreal. Industrial, engineering experience would be useful. Duties include time-study in Standards Department. Salary open. Apply to File No. 3980-V.

MECHANICAL ENGINEER, age 25 to 30 is required by a company in Shawinigan Falls to eventually act as Assistant Works Manager when qualified. Salary open. Apply to File No. 3985-V.

GRADUATE MECHANICAL ENGINEERS, preferably with five or more years' experience, required by engineering concern in Montreal area engaged in manufacture of hydraulic turbines and mining machinery. Salary open. Apply to File No. 3992-V.

MISCELLANEOUS

INDUSTRIAL ENGINEERS, with production experience required by a firm of industrial consultants in Montreal. Preferably with experience in time study, cost control, etc. Salary around $400 depending on qualifications. Apply to File No. 3910-V.

SALES ENGINEER required by well-known manufacturer of mechanical equipment to solicit industrial accounts throughout the Province of Quebec. Applicants must reply giving full details, age, training, etc. Salary open. Apply to File No. 3951-V.

GRADUATE ENGINEER, experienced in work analysis and job simplification. Should be bilingual and experienced in handling staff. Permanent position in Montreal. Salary $350. with good prospects for advancement. Apply to File No. 3959-V.

INDUSTRIAL ENGINEER to act as assistant in the Engineering Department of Meat Packing firm with plants throughout Canada. Headquarters in Calgary. Requires knowledge of building construction, mechanical maintenance and power plant work. Experience in refrigeration desirable. Salary open. Apply to File No. 3960-V.

DRAUGHTSMEN preferably with electrical or mechanical background for industrial plant layout and electrical and mechanical equipment of buildings required by a firm of consultants in Montreal. Salary open. Apply to File No. 3964-V.

JUNIOR SALES ENGINEERS with production experience required by a firm of industrial consultants in Montreal. Salary $300 depending on qualifications. Apply to File No. 3965-V.

PRODUCTION AND DEVELOPMENT ENGINEER required as Plant Manager to expand existing plant of an Ontario manufacturer specializing in plantation hoes and cane knives. Salary $4,500. to $5,000. Apply to File No. 3967-V.

GRADUATE ENGINEER or Physicist with thorough understanding of microwave radio techniques required by government establishment in the Ontario area. Experience with microwave radar, or radar or radio equipment in the Armed Services desirable. Salary open. Apply to File No. 3969-V.

PRODUCTION SUPERVISOR, age 30 to 45 years, with experience in sheet metal fabrication required by established Canadian manufacturer in Ontario. Salary open. Apply to File No. 3970-V.

DRAUGHTSMEN of the following classes: piping layout, refinery construction, structural detailer and detailing and draughting power lines required by a firm of Engineer Contractors in Alberta, Canada. Salaries $250 to $300. per month. Apply to File No. 3972-V.

GRADUATE ENGINEERS age 20-35, with training in one or more of the following lines—foundation work, involving reinforced concrete; structural steel; steam and process piping; oil refinery experience; boilers; pumps and heat exchange equipment and miscellaneous machinery; required by oil company in Montreal. Salary open. Apply to File No. 3974-V.

ENGINEER with estimating and cost experience, able to read blueprints, take of and price assembly shop operations and fully capable of organizing and installing a Standard Cost System. Required by a manufacturer in Southern Ontario. Salary according to qualifications and ability. Apply to File No. 3977-V.

JUNIOR ENGINEER with estimating and time study experience covering tools and dies and general machine shop work required by a Machine and Tools manufacturer in Ontario. Some experience in designing and engineering department would be an advantage. Salary open. Apply to File No. 3979-V.

GRADUATE ENGINEER, with some experience in a manufacturing industry required by Hamilton company. Some knowledge of production operations, mill scheduling, job evaluation, time-study, job methods, industrial relations would be helpful. Salary open. Apply to File No. 3981-V.

GRADUATE ENGINEER interested in sales, preferably with electrical background, required in Montreal. Salary around $275. Apply to File No. 3983-V.

JUNIOR ENGINEER required by a Wholesale Coal Importing Co. in Montreal for duties, primarily co-operation with Sales Department in combustion service work. Salary open. Apply to File No. 3984-V.

The following advertisements are reprinted from last month's Journal, having not yet been filled.

CHEMICAL

CHEMICAL ENGINEER OR CHEMIST, preferably with Ph.D., required by a pulp and paper company with plants in Eastern Canada, for research work. Salary open. Apply to File No. 3549-V.

CHEMICAL ENGINEER required by a pulp and paper company with plants in Eastern Canada, for mill control and pilot plant work. Salary open. Apply to File No. 3549-V.

CHEMICAL ENGINEER required for the control department of a paper mill in Shawinigan Falls. Salary from $250-350. Apply to File No. 3765-V.

CHEMICAL ENGINEER OR CHEMIST interested in textile dyeing, required by an industrial firm in South Western Quebec. Salary open. Apply to File No. 3798-V.

CHEMICAL METALLURGIST with background in extraction metallurgy and ore dressing (knowledge of minerology desirable) and experience in use of petrographic microscope. Required for research work in B.C. Maximum salary $4,000. Apply to File No. 3865-V.

CHEMICAL ENGINEER with considerable mechanic and hydraulic experience or mechanical engineer with good chemical knowledge and experience in hydraulics, required by a manufacturer in Ontario. Salary open. Apply to File No. 3928-V.

CHEMICAL ENGINEER OR CHEMIST required by a Pulp and Paper Mill in Ontario to develop, install and directly supervise the operation of technical control systems for raw material, inspection process control, quality reporting, inventory, measurement and product satisfaction. Salary open. Apply to File No. 3938-V.

CHEMICAL ENGINEER OR CHEMIST required as Technical Superintendent to administer the Technical Department of a Pulp and Paper Mill in Ontario. Minimum of 5 years in technical or production work in the pulp and paper industry. Salary open. Apply to File No. 3938-V.

CHEMICAL ENGINEER required by Pulp and Paper Mill in Ontario to undertake the solution of manufacturing and technical control problems, etc. Preferably experience in the pulp and paper industry. Salary open. Apply to File No. 3938-V.

CIVIL

CIVIL ENGINEER to take charge of work in a drainage district in Quebec. Must be bilingual. May be recent graduate. Salary from $200. Apply to File No. 3479-V.

CIVIL ENGINEERS with experience in detailing and designing structural steel and reinforced concrete for manufacturers are required for a steel fabricating company in Manitoba. Salary open. Apply to File No. 3519-V.

CIVIL ENGINEER, recent graduate up, required by a pulp and paper company with plants in Eastern Canada. Salary open. Apply to File No. 3549-V.

CIVIL ENGINEER, age 35-40, with extensive experience in detailing and checking structural steel in buildings and bridges, required by a steel fabricating company in Southern Ontario. Salary open. Apply to File No. 3570-V.

CIVIL ENGINEERS AND ASSISTANT HYDRAULIC ENGINEERS required for government organization on West Coast for highway and construction. Salary open. Apply to File No. 3724-V.

CIVIL ENGINEER, qualified O.L.S., required as town engineer and superintendent of works for a town in Central Ontario. State age and salary desired. Apply to File No. 3750-V.

GRADUATE CIVIL ENGINEER, required by a public utility in the Montreal area with three or four years' experience in design of reinforced concrete and structural steel. Salary $250-$300. Apply to File No. 3766-V.

GRADUATE CIVIL ENGINEER, required as structural designing engineer by a firm engaged in the manufacture of cranes, crushers, pumps, etc., in the Toronto area. Preferably with 5 to 10 years' experience in designing and detailing steel buildings and bridges. Salary open. Apply to File No. 3771-V.

GRADUATE CIVIL ENGINEER required by an industrial corporation in Montreal for design work in draughting room. Must be familiar with structural steel and concrete design. Salary from $250 up, according to experience. Apply to File No. 3785-V.

CIVIL ENGINEERS with some experience on design and field work required by a public utility in Toronto. Salary open. Apply to File No. 3813-V.

CIVIL ENGINEER, age 35-40, with considerable experience in design of structures, water supply, sewers, required by an organization in Montreal. Salary $300-$400. Apply to File No. 3820-V.

CIVIL ENGINEERS required as draughtsmen in bridge department of large transport company. Preferably with experience in steel, concrete and timber construction. Location Montreal. Salary $200-$300. Apply to File No. 3884-V.

CIVIL ENGINEER, required in New Brunswick. Must be qualified designer of miscellaneous public utility buildings in frame and masonry construction. Thorough working knowledge of timber, reinforced concrete and steel framing essential, knowledge of the design of various types of heating systems and plumbing. Salary open. Apply to File No. 3887-V.

CIVIL OR STRUCTURAL ENGINEER, 24-35 years, required for Northern Ontario Paper Mill. At least 2 years' construction and 2 years' design experience. Opportunity to train junior personnel. Salary not less than $350. Apply to File No. 3891-V.

CIVIL ENGINEER, required by a firm in the St. Maurice Valley to be in charge of improvements in woods operations such as dams, bridges, roads, etc. Must be bilingual. Salary $350. Apply to File No. 3902-V.

CIVIL ENGINEER required as Town Engineer of a town in the Maritimes. Required to supervise and layout work for Water and Sewerage Department, Works Department also construction of a general nature for the Electric Light Department. Salary open. Apply to File No. 3930-V.

CIVIL ENGINEER, required by a steel company in Montreal for the design of reinforced concrete frame. Salary open. Apply to File No. 3931-V.

CIVIL ENGINEER, recent graduate, required in Montreal for Construction work, setting up of machinery, general engineering. Salary $200. Apply to File No. 3949-V.

ELECTRICAL

ELECTRICAL ENGINEER, age 30-45, with sales training required by large manufacturer of electrical equipment instruments and must have 5-10 years' experience as sales service and sales engineer. Required as sales engineer in Canada for U.S. firm making special equipment for transport and industry. Salary open. Apply to File No. 3447-V.

ELECTRICAL ENGINEER, recent graduate, required for the engineering staff of a paper mill in the Lake St. John area. Salary open. Apply to File No. 3507-V.

ELECTRICAL ENGINEER with considerable industrial experience required as a safety engineer by a public utility in the Montreal area. Bilingual preferred. Salary open. Apply to File No. 3654-V.

ELECTRICAL ENGINEER, with general knowledge of A.C. and D.C. motors, switch gear, mercury rectifiers, transformers and other electrical apparatus, for sales work in Eastern Canada. Age 30 to 35. Salary open. Apply to File No. 3695-V.

ELECTRICAL DRAUGHTSMEN with several years' experience in industrial layouts for large concern in Eastern Townships. Permanent position and attractive salary available for experienced men. Apply to File No. 3701-V.

ELECTRICAL ENGINEER, required by an insurance company, preferably with a few years practical experience for the inspection of boilers, steam plant and allied equipment in Montreal area. Salary open. Apply to File No. 3754-V.

ELECTRICAL ENGINEER, recent graduate up, required by a manufacturer in Montreal for sales engineering. Preferably bilingual and familiar with rotating electrical equipment. Salary $200 up. Apply to File No. 3761-V.

GRADUATE ELECTRICAL ENGINEERS, with 3 to 10 years' experience in design, operation, layout of substations, switching stations, and electrical machinery together with engineering studies, including draughting for a large Hydro Electric power house in Quebec. Salary $225 up according to experience. Apply to File No. 3787-V.

ELECTRICAL ENGINEER required for power sales by an electrical utility in Province of Quebec. Preferably experienced. Bilingual. Salary open. Apply to File No. 3802-V.

ELECTRICAL ENGINEERS, with experience in layout and design of generating and transformer stations, required by a public utility in Toronto. Salary open. Apply to File No. 3813-V.

SEVERAL EXPERIENCED ELECTRICAL DRAUGHTSMEN for the design and layout of industrial power and control systems. Required by consulting engineering office in Montreal. Salary open. Good chance for advancement. Apply to File No. 3890-V.

JUNIOR ELECTRCAL ENGINEER, with practical experience in general manufacturing industries, required by an industrial organization in Ontario. Salary open. Apply to File No. 3904-V.

ELECTRICAL ENGINEER, recent graduate, required by a paper company for work in mill equipment and power generators. Salary $225. Apply to File No. 3906-V.

ELECTRICAL ENGINEER required as Assistant Superintendent, Light and Power Department, Saskatchewan City. Must have several years' experience in Utility field. Minimum starting salary $3,600. Apply to File No. 3913-V.

ELECTRICAL ENGINEERS, required for sales engineering work in Western Canada. Graduates with some selling experience preferred. Salary open, plus expenses. Apply to File No. 3915-V.

ELECTRICAL ENGINEER, recent graduate, required in Montreal for general engineering on telephone and radio. Salary $175-$225. Apply to File No. 3923-V.

ELECTRICAL ENGINEER wanted for new Chemical Plant in Western Ontario. Engineer must have had previous Electrical Rectification experience. Salary open. Apply to File No. 3945-V.

JUNIOR ELECTRICAL ENGINEER, age about 30, required as assistant to Superintendent of Light Department in Montreal area. Practical experience in Hydro Distribution and Steam Turbines. General office routine of administrative nature. Salary open. Apply to File No. 3950-V.

MECHANICAL

MECHANICAL ENGINEERS, preferably with design experience, are required for armament research and development in the Quebec area, in a government establishment. Salary from $190. Apply to File No. 3401-V.

MECHANICAL ENGINEER with experience in pulp and paper or mining work required by a pulp and paper company with plants in Eastern Canada. Salary open. Apply to File No. 3549-V.

GRADUATE MECHANICAL ENGINEERS required for Sessional appointment as Instructors for 8 months and Demonstrators for 7 months. Salary open. Apply to File No. 3600-V (1).

MECHANICAL ENGINEER with experience in the fabrication of Farm Implements, required by a Quebec firm. Bilingual man preferred. Salary according to experience. Apply to File No. 3666-V.

MECHANICAL ENGINEER with design experience in the pulp and paper industry required by a firm in the St. Maurice Valley. Salary $350. Apply to File No. 3673-V.

JUNIOR MECHANICAL ENGINEER with knowledge of precision machine shop practice and aptitude for research work in metals and plastics required for an organization in Toronto for the production of artificial limbs. Must be veteran. Salary from $225. Apply to File No. 3675-V.

MECHANICAL ENGINEERS with at least five years experience in the pulp and paper industry required by an Ontario Paper Company. Salary open. Apply to File No. 3733-V.

MECHANICAL ENGINEER with experience in heating, ventilating and air-conditioning required by a consulting engineer in Montreal. Salary open. Apply to File No. 3773-V.

MECHANICAL ENGINEERS required by a pulp and paper mill at Powell River, B.C. Preferably with experience in plant design in the pulp and paper industry. Salary according to qualifications. Apply to File No. 3796-V.

RECENT GRADUATES OR JUNIOR ENGINEERS with mechanical background, required by a Montreal Engineering, fabricating and contracting firm for training purposes leading to sales and service. Area Montreal. Salary $175 up. Apply to File No. 3810-V.

MECHANICAL ENGINEERS with experience in plant layout and design or ventilation problems or general mechanical design, required by a firm in Quebec. Salary from $250. Apply to File No. 3818-V.

MECHANICAL ENGINEER, age 35-40 with considerable experience in design and layout of machinery and equipment, required by an organization in Montreal. Salary $300-$400. Apply to File No. 3820-V.

MECHANICAL ENGINEER with six to ten years, experience in maintenance and engineering work required by alkali manufacturers in Ontario. Salary open. Apply to File No. 3833-V.

MECHANICAL ENGINEER, required by a manufacturer in Ontario for the plant operation staff. Salary open. Apply to File No. 3833-V.

MECHANICAL ENGINEER, recent graduate up, required by a company in Montreal for toll design. Salary $175 up. Apply to File No. 3843-V.

MECHANICAL ENGINEER with knowledge of physical metallurgy, heat treatment, ability in stress analysis and design. Required for research work in B.C. Maximum salary $4,000. Apply to File No. 3865-V.

MECHANICAL ENGINEER, age 30-38, required for northern Ontario paper mill. Preferably with paper mill experience or experience in general layout and design. Knowledge of pumps capacities, piping, conveyors, estimating and structural design essential. Salary open. Apply to File No. 3891-V.

MECHANICAL ENGINEER, bilingual, with 4 or 5 years, experience in sheet metal work required as Plant Manager by a manufacturer in the Province of Quebec. Salary open. Apply to File No. 3894-V.

MECHANICAL ENGINEER required by a firm of Power House and Building Specialists to act as representative in the Toronto Territory. Must be familiar with that district. Preferably manufacturers' agent to act as sub-agent. Apply to File No. 3397-V.

MECHANICAL ENGINEER, age 25 to 35, experienced in industrial plant, layout and machine design required by manufacturing firm in Brantford. Salary open. Apply to File No. 3907-V.

MINING

MINING ENGINEERS, with varied experience required by a firm in Quebec for general mine operation, exploitation and development work. Salary from $250. Apply to File No. 3818-V.

MINING ENGINEER with several years' experience required by a company engaged in large scale asbestos production in Quebec. Salary open. Apply to File No. 3935-V.

MISCELLANEOUS

MANAGEMENT ENGINEERS with business administration and mechanical background, age 30 up, bilingual with at least 5 years practical experience, required by an industrial engineering consultant in Montreal. Salary open. Apply to File No. 3307-V.

STRUCTURAL STEEL DRAUGHTSMAN AND CHECKERS, preferably graduate engineers but any experienced men acceptable, are required for a steel fabricating company in Manitoba. Salary open. Apply to File No. 3519-V.

ASSISTANT PLANT ENGINEER with paper mill experience required by a pulp and paper company with plants in Eastern Canada. Salary open. Apply to File No. 3549-V.

GRADUATE ENGINEERS required by an industrial and chemical organization with headquarters in Montreal for all phases of research, design, operation development, production and maintenance. Salaries open. Apply to File No. 3538-V.

CHIEF ENGINEER with industrial experience required for a steel fabricating plant in Western Canada. Salary open. Apply to File No. 3616-V.

DESIGN DRAUGHTSMAN for the design of cranes and hoists of all types, capable of making and checking complete manufacturing detail drawing, required by a manufacturer in Southern Ontario. Apply by letter with full details. Salary open. Apply to File No. 3628-V.

SALES ENGINEER with wide engineering experience, wanted by a company in Toronto for the sale of textile machinery and construction equipment. Salary open. Apply to File No. 3639-V.

JUNIORS ENGINEERS, recent graduates up, as designing draughtsmen for a brewing company with headquarters in Montreal. Salary from $200. Apply to File No. 3670-V.

CHEMICAL OR METALLURGICAL ENGINEERS, from recent graduates up, required by a Quebec firm engaged in metal production for employment as production and development engineers. Salaries open. Apply to File No. 3693-V.

MINING AND METALLURGICAL ENGINEER, age about 30, with considerable experience, required by a manufacturer in the St. Maurice Valley. Salary open. Apply to File No. 3723-V.

CONSTRUCTION ENGINEER with considerable experience required for the permanent staff of a Montreal inspection company. Salary about $200. Apply to File No. 3728-V. Age immaterial.

STRUCTURAL STEEL DETAILER AND CHECKER with considerable experience required for checking shop details by a steel fabricating firm in Montreal. Salary open. Apply to File No. 3740-V.

DETAILER AND DESIGNER, for reinforcing steel with considerable experience required by a steel fabricating firm in Montreal. Salary open. Apply to File No. 3740-V.

SALES ENGINEER, preferably bilingual, required by a Montreal firm dealing in building materials. Salary from $200. Apply to File No. 3745-V.

GRADUATE ENGINEER required by an electrical firm in Montreal, to organize publicity department and edit trade journal. Salary open. Apply to File No. 3751-V.

CHIEF DRAUGHTSMAN with experience in Pulp and Paper Mill design wanted immediately in Port Arthur. Reply stating education, experience. Salary open. Apply to File No. 3760-V.

STRUCTURAL STEEL DRAUGHTSMAN, qualified to detail and check all classes of structural steel and to supervise draughtsmen in a large drawing office on the West Coast. Salary open. Apply to File No. 3777-V.

BRIDGE ENGINEER, qualified to be in charge of the design and supervision of the construction of highway bridges. Apply stating qualifications, experience, age and salary wanted. Apply to File No. 3780-V.

GRADUATE CIVIL OR MECHANICAL ENGINEERS with 3 to 10 years' experience in design, cost estimates, draughting and engineering studies for a large hydro-electric power house in Quebec. Salary $225 up according to experience. Apply to File No. 3787-V.

STEAM PLANT ENGINEER for large concern in Eastern Townships, with at least 5 years practical experience. Must be familiar with thermo-dynamics, combustion control, steam turbines, mechanical refrigeration, hydraulics, etc. Permanent position and attractive salary for the right man. Apply to File No. 3791-V.

STRUCTURAL ENGINEER required by a firm of consulting engineers in Montreal for design work. Must have experience in structural steel and reinforced concrete. Salary open. Apply to File No. 3811-V.

GRADUATE ENGINEER, preferably with chemical and industrial experience required to supervise operations at the Sodium Sulphate Plant now being constructed at Chaplin, Saskatchewan. Apply to File No. 3821-V.

DRAUGHTSMEN required by a pulp and paper mill in the Eastern Townships for general draughting and detailing. Three or four years' experience preferred but not essential. Salary open. Apply to File No. 3823-V.

DRAUGHTSMAN, preferably with mechanical background, required by a manufacturer in Montreal for design work on electrical equipment. Salary open. Apply to File No. 3829-V.

CITY ENGINEER required by City of Moose Jaw, Saskatchewan. Salary open. Apply to File No. 3856-V.

DRAUGHTSMEN of the following classes—Architectural, piping layout, equipment layout, mechanical design, steam plant, heating, and ventilating, electrical and plumbing required by an industrial organization in Montreal. Salaries open. Apply to File No. 3860-V.

STRUCTURAL STEEL CHECKER AND ONE DETAILER CHECKER wanted for large fabricating plant in Vancouver, B.C. Age between 30 and 40 years preferred. Must be experienced. Give full information and references. Salary open. Apply to File No. 3862-V.

MECHANICAL, CHEMICAL OR CIVIL ENGINEERS, recent graduate up, required for sales and service in Alberta by a Montreal manufacturer. Salary open. Apply to File No. 3867-V.

MECHANICAL OR CHEMICAL ENGINEER, recent graduate, required by a firm in Montreal. Ability to do simple drawings, such as layout of piping and instruments. Some experience in oil refinery or chemical plant or pulp and paper would be useful. Position to eventually lead to sales. Salary $200. Apply to File No. 3879-V.

GRADUATE ENGINEERS required for all phases of research, design, operation, development by an industrial organization in Montreal. Salaries open. Apply to File No. 3882-V.

SALES ENGINEERS required by established Canadian Manufacturer of fabricated steel products. Some construction experience an advantage. Wanted for Maritimes, Ontario and Manitoba. Salaries open. Apply to File No. 3883-V.

GRADUATE ENGINEER, familiar with industrial processes, metallurgical and chemical engineering as applied to steel, copper, mining and chemical plants. Broad general experience in estimating and designing. Salary open. Toronto area. Apply to File No. 3886-V.

INDUSTRIAL ENGINEER preferably with mechanical background and several years experience in time studies, estimating, etc. Required by a manufacturer in Montreal. Salary $250. up according to experience. Apply to File No. 3893-V.

STRUCTURAL ENGINEER preferably a graduate civil engineer with experience in the design of mill buildings required by a paper manufacturer in Eastern Ontario. Salary open. Apply to File No. 3896-V.

SALES ENGINEER, mechanical background, preferably with experience in refrigeration field, required by a Montreal firm. Salary $250-$300. Considerable travelling. Apply to File No. 3898-V.

DETAILERS OR JUNIOR DESIGNERS on mechanical or sheet metal design required by an industrial organization in Ontario. Salary open. Apply to File No. 3904-V.

RECENT GRADUATES in electrical or mechanical engineering can still be offered the opportunity of being trained by large Hydro-Electric Utility. Very good opportunities for regular employment in various departments at the completion of training period. Minimum salary 1st year $200; 2nd year $215. Apply to File No. 3912-V.

CIVIL OR MECHANICAL ENGINEER interested in the sales and engineering of power transmissions, gravity conveyors and grain separators, required in Western Canada. Salary open. Apply to File No. 3915-V.

GRADUATE ENGINEER OR PHYSICIST, bilingual, preferably with knowledge of X-Rays required by Canadian office of worldwide electronic concern to manage X-Ray application engineering activities. Salary $2,700 to $3,600. or more depending on qualifications. Apply to File No. 3917-V.

JUNIOR ENGINEER with some structural experience required by large milling company with headquarters in Toronto for design work on flour and feed mill buildings and equipment. Salary open. Apply to File No. 3918-V.

GRADUATE ENGINEER required by a specialized industrial plant in the Montreal area to head up Production Department. Suitable applicant should be good organizer with plenty of initiative and preferably with machine shop production experience. Salary $300 up. Apply to File No. 3924-V.

Industrial Engineer

to act as assistant in the Engineering Department of Meat Packing firm with plants throughout Canada. Headquarters in Calgary. Requires knowledge of building construction, mechanical maintenance, and power plant work. Experience in refrigeration desirable. Salary open. Apply to File No. 3960-V.

Mechanical Engineer

with experience in plant lay-out and knowledge of reinforced concrete, timber and steel design, required in an industrial manufacturing and processing plant situated in Laurentians 75 miles from both Ottawa and Montreal—2 hours drive to either city. Write giving all pertinent data to File No. 3990-V.

AERONAUTICAL ENGINEER required in Montreal with 5 years' experience in aircraft industry of which 3 years should have been in aerodynamics work and 2 years in advanced flight test reduction or performance analysis. Salary open. Apply to File No. 3926-V.

GRADUATE ENGINEER from a recognized University, preferably in the field of Applied Science, with a few years of industrial experience and fluently bi-lingual, possession or ability to obtain an automobile for transportation essential. Required in Montreal. Salary open. Apply to File No. 3927-V.

GRADUATE ENGINEER, mechanical, electrical or civil, about 30 years of age, required by a large Hydro-Electric Utility in Montreal for field testing hydraulic turbines. Salary open. Apply to File No. 3932-V.

RECENT GRADUATE required by a Montreal contractor for survey and making of plans. Must be bilingual. Salary $175 up according to experience. Apply to File No. 3933-V.

TOWNSITE ENGINEER OR MANAGER required by an Ontario Pulp and Paper Mill. Townsite part under construction. Salary open. Apply to File No. 3936-V.

RECENT GRADUATE willing to learn and study in detail the welding industry required by an industrial organization in Montreal. Salary open. Apply to File No. 3937-V.

MECHANICAL OR CHEMICAL ENGINEER required by a Pulp and Paper mill in Ontario to secure continuous optimum performance from all process instruments, maintenance of instruments, etc. Salary open. Apply to File No. 3938-V.

TWO METALLURGICAL ENGINEERS AND ONE CHEMICAL ENGINEER required by large metallurgical firm in the Maritimes. Good opportunity for advancement in Research, Development and Production. Salary open. Apply to File No. 3942-V.

INDUSTRIAL ENGINEER thoroughly experienced in time study standard data and wage incentive installation and administration required for firm in Quebec. Salary open. Apply to File No. 3952-V.

Situations Wanted

PLANT ENGINEER

M.E.I.C., B.Sc. P. Eng. (Ontario, Quebec). Age 40. Married. Eighteen years' experience, past eleven being in various phases of newsprint and sulphite pulp mill administration, maintenance and engineering. Presently employed, desires position preferably in English speaking locality. Available on one month's notice. Apply to File No. 1384-W.

CONSULTING ENGINEER, M.E.I.C., Prof. Eng. Que., Mech. '30 McGill, newly established not fully occupied available to assist others short of staff. Present contracts in woodworking industry and commercial buildings and experience in industrial research, mechanical and heating equipment, cost studies, organization and factory layout. Apply to File No. 631-W.

ELECTRICAL ENGINEER, Jr. E.I.C., P.E., Que., McGill '44, Single, Bilingual, ex-naval Officer, two years' experience as assistant electrical superintendent in a large industrial plant. Desires change in position. Apply to File No. 1450-W.

GRADUATE CIVIL ENGINEER, M.E.I.C., over 20 years' experience in U.S.A. and Canada as designer and Superintendent of construction of dams and hydraulic Power Plants. Desire responsible position in well established firm where extensive construction is contemplated. Location immaterial. Now employed, but available. Apply to File No. 1527-W.

CIVIL ENGINEER, P. Eng. Jr. E.I.C., McGill graduate, would like spare time work in design of reinforced concrete or structural steel on a fee basis or otherwise. Also qualified for checking drawings and estimating quantities and cost. At present employed in the Montreal district. Apply to File No. 1552-W.

CHEMICAL ENGINEERING GRADUATE, M.E.I.C., age 26, Veteran, single, 2 years oil refinery experience in South America, experienced in estimating, inspection and maintenance. Desires position in Canada or U.S. Available February 1st. Apply to File No. 1570-W.

GRADUATE MECHANICAL ENGINEER, M.E.I.C., P. Eng. (Que.), M.A.S.T.E. Stuttgart 1924, married. 18 years' experience in experimental work, plant maintenance, aircraft, jig and tool design, Mechanical equipment and handling fixtures. Available at short notice. Montreal area preferred. Apply to File No. 1862-W.

MECHANICAL ENGINEER, S.E.I.C. seven years' experience, including structural design and detail (steel and reinforced concrete.) Plant layout, machine design, plant maintenance, also estimating and field work, at present employed in heavy industry in Western Canada. Wishes to locate in East, preferably Ontario or Quebec. Age 27, married. Apply to File No. 2225-W.

ELECTRONICS ENGINEER, Jr. E.I.C., B.E.E., McGill, 1938, S.M.—M.I.T.—1942. P. Eng. Quebec, with 10 years general design and supervisory experience in electronics desires position or partnership with consultant or manufacturing firm with view towards exploiting the field of electronics and electronic controls in industry. Location, anywhere, but preferably Montreal. Apply to File No. 2492-W.

EXECUTIVE ENGINEER, M.E.I.C., B.A.Sc., R.P.E. (B.C.). Veteran, age 35, married. 15 years Civil engineering and construction, over 7 years in executive capacity. Interested in position with construction or industrial firm in British Columbia or Ontario. Apply to File No. 2515-W.

GRADUATE CIVIL ENGINEER, Jr. E.I.C., P. Eng. (Ont.) with wide experience in building construction and design, desires spare time employment evenings and weekends on design of reinforced concrete, steel and masonry structures, preferably on a fee basis. Location Toronto. Apply to File No. 2581-W.

CHEMICAL ENGINEER, McGill, age 27, married. Experienced manager, in charge personnel, production, purchasing. Synthetic resin research, distillation. Plant and laboratory control. Time study. Sales. Available immediately. Bilingual. $4,500 year last position. Apply to File No. 2850-W.

ELECTRICAL ENGINEER, M.E.I.C., Grad. I.E.E., thorough grounding in cable and transformer manufacture, development and estimating. Also extensive instrument making experience in Government Laboratories. Anxious to contact companies re-openings in application, sales, maintenance or production engineering. Age 26. Single. Apply to File No. 2876-W.

STEAM-ELECTRIC POWER PLANT ENGINEER, 38, B.Sc., M.E.I.C., A.M.I.E.E. 3 years manufacturing, installation, and sales office experience in metalclad switchgear, protective equipment, instruments, motors, etc. 9 years practical and administrative experience in operation and maintenance of Power Plant Electrical Equipment, high and extra high pressure large capacity chain grate and pulverized fuel water tube boilers, condensing, turbines, and associated apparatus. Available November 1st. Apply to File No. 2891-W.

MINING ENGINEER-GEOLOGIST, M.Sc. M.E.I.C., age 35, eight years' experience in mining industry; some chemical, mechanical, industrial experience. Desires position with progressive manufacturing firm in Alberta or B.C. Industrial minerals field preferably. Willing to invest in sound business. Available one month. Apply to File No. 2892-W.

GRADUATE ENGINEER, P. Eng. (Que.), S.E.I.C., B.Sc.A. from Ecole Polytechnique, Montreal, Bilingual, would accept part time work during evenings and week-ends, at home preferably. Specialized in heating problems, including Forced Hot Water Systems, Low Pressure Steam Systems and Air Conditioning. Presently employed and residing in Montreal area. Apply to File No. 2898-W.

CHEMICAL ENGINEER, B.A.Sc. Toronto '43, Jr. E.I.C., age 28, married; 4 years' experience including chemical process equipment installations, maintenance, manufacturing methods and laboratory control in a large manufacturing company. Interested in a change of employment which would offer more scope in the chemical field. Prefer Ontario location. Available 1 month's notice. Apply to File No. 2901-W.

JUNIOR ELECTRICAL ENGINEER, Jr. E.I.C., P.E.Q., age 28, married. Actually on the staff of the Electrical Department of a Canadian University would prefer work in industry. Experience in electrical machinery and meters. Available on one month's notice. Apply to File No. 2902-W.

GRADUATE CIVIL ENGINEER, B.Sc., Alberta, 1947, S.E.I.C., Married, desires position doing structural design work. Preferably in reinforced concrete or steel. Two years' experience in draughting and half year practical work in field. West Coast area preferred but would consider other localities. Presently employed and residing in Edmonton. Apply to File No. 2907-W.

CIVIL ENGINEER, B.A.Sc. (Toronto), S.E.I.C, P. Eng. (Ont.), with some experience in reinforced concrete and structural steel design including detailing of reinforced concrete and estimating; would accept part time work during evenings and weekends. At present employed and residing in the Toronto area. Apply to File No. 2910-W.

LIBRARY NOTES *(Continued from page 640)*

APPLIED ATOMIC POWER:

E. S. C. Smith, A. H. Fox, R. T. Sawyer, H. R. Austin. Prentice-Hall, New York, 1946. 227 pp., illus., diagrs., charts, maps, tables, 9¼ x 6 in., cloth, $4.00.

The purpose of this book is to explain in relatively simple language just what atomic power is, and to discuss how that power may be applied to our everyday needs and purposes. Although the most important section is that dealing with the conversion of atomic energy into mechanical power, other topics are effectively covered, such as: the mineral uranium, the phenomenon of fission, and the problems encountered in the production of plutonium.

JIGS and FIXTURES for MASS PRODUCTION:

L. A. Bryant and T. A. Dickinson. Pitman Publishing Corp., New York, Chicago and Toronto, 1947. 222 pp., illus., diagrs., tables, 9¼ x 6 in., cloth, $3.50.

This practical book describes the design and construction of the various types of jigs and fixtures, covers the subjects of plastics, pneumatics and hydraulics as applied to tooling, and considers the important recent developments in tooling procedures such as the master tooling dock. Particular attention is given to assembly tooling on which large-scale production so largely depends. There is a glossary, and a list of tool symbols is suggested for a tool-identification code.

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